Boggs Road Mine Drainage Remediation System

Final Report 2005

Montour Run Watershed Association

PUBLIC-PRIVATE PARTNERSHIP EFFORT

Grant Administration, Volunteer Wetland Planting, Education & Outreach, etc.
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Landowner Support
KROPF, William K. & Mary K., Findlay Twp., Allegheny Co., PA
Imperial Land Corporation, 200 Neville Road, Pittsburgh, PA 15225
BUNDA, Gerald F., President (412) 777-6626 (maintenance fund cash contribution)

State Grant Administration
PA Department of Environmental Protection, Bureau of District Mining Operations,
Armbrust Building, RD 2, Box 603C, Greensburg, PA 15601-0982
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415 Market Street, Suite 3, Harrisburg, PA 17101
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Site Access
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JESSLOSKI, David, Director; REIDENBAUGH, Jeff, Sustainable Systems Engineer (724) 290-2901

Passive Treatment System Design
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DANEHY, Timothy, QEP; REICHARD, Kevin, PE; DUNN, Margaret, PG; BUSLER, Shaun, GISP; DENHOLM, Cliff, Environmental Scientist; DURRETT, Kyle, Geology Technician; DANEHY, Sylvia, Office Mgr. (724) 776-0161

Passive Treatment System Construction and 5-Year Maintenance
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ALOE, Joseph, President; ANKROM, Jeff, Vice President; FUCHS, Wayne & STEINER, Kevin, Site Construction (412) 777-6717; (724) 290-2100

ADDITIONAL SUPPORT/IN-KIND

McClymond's Supply & Transit Co., Inc. (in-kind); G & C Coal Analysis Lab., Inc. (in-kind); Findlay Township Supervisors (support); PA Senator John Pippy (support); Wildlife Habitat Council (support); Stream Restoration Inc. (in-kind); US Army Corps of Engineers (assessment/permitting)

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FINAL REPORT

BOGGS ROAD MINE DRAINAGE REMEDIATION SYSTEM

Montour Run Watershed, Findlay Township, Allegheny County, PA

Submitted to

Pennsylvania Department of Environmental Protection
U. S. Department of Interior Office of Surface Mining

EXECUTIVE SUMMARY

With generous landowner support by the William Keith Kropf family and Imperial Land Corporation, the Montour Run Watershed Association was awarded grants in late 2003 from the PA Department of Environmental Protection Growing Greener Program and from the U. S. Office of Surface Mining Clean Streams Program. The purpose was to fund, in combination with matching and in-kind, the installation of an environmentally-friendly, low maintenance, facility to treat alkaline, metal-bearing, drainage from an abandoned surface coal mine that degraded South Fork Montour Run. Education and outreach were also incorporated into system implementation to promote future watershed restoration efforts.

Within two years, all necessary permits/approvals had been received and the passive treatment system had been designed and installed. The timely project implementation and efficient use of available resources were made possible by cooperation through a public-private partnership effort with federal, state, and local agencies; private industry; nonprofits; landowners; and volunteers. Particularly instrumental for efficient system construction was the approval of Browning Ferris Industries to extend an access road from an existing private roadway to the construction site. Furthermore, in order to initiate a trust fund for long-term system maintenance, matching funds were provided by Imperial Land Corporation.

Designed to minimize installation costs, to optimize available space, and to conform to the natural setting, the passive treatment system includes a forebay and an aerobic wetland complex consisting of bioswales, settling ponds, and wetlands. Based on available pre- and post-construction water monitoring, the system is preventing about **8,000** to **10,000 pounds** of metals annually from entering South Fork Montour Run.

Boggs Road Mine Drainage Remediation System

Sample Point	Description	Flow (gpm)	pH (field/lab)	Alk. (field/lab)	Acidity	Fe	Mn
149-1 (n=13)	Untreated AMD (passive system influent)	30	6.2/6.1	155/104	21	86	8
SFMU2 (n=6)	Treated AMD (passive system effluent)	26	7.3/6.9	36/33	-4	2	10

Average values; 149-1 pre- and post-construction data; SFMU2 post-construction only; pre-construction 149-1 flow measured at weir; post-construction flow measured at weir below final pond; alkalinity and acidity as mg/L $CaCO_3$; dissolved iron and manganese (mg/L); pH not averaged from H-ion content

COMPREHENSIVE TIMELINE

Tour/MRWA Site Meeting News Item

Date	Description
11/08/01 11/21/02	Monitoring of AMD discharge by John Davidson, MCI, PADEP and MRWA
02/17/02	Montour Run Watershed Association meeting; discusses restoration options with BioMost
12/24/02	Pre-grant submittal site investigation conducted by John Davidson (PA DEP), Keith Kropf (landowner), and BioMost
01/17/03	Pre-grant submittal site visit conducted by Aquascape, Quality Aggregates, BioMost
02/03/03	Boggs Road Mine Drainage Remediation System Grant proposal submitted to DEP by Montour Run Watershed Association
07/31/03	Boggs Road Mine Drainage Remediation System Grant proposal submitted to OSM by Montour Run Watershed Association
08/26/03	Montour Run Watershed Association meeting
09/--/03	Abandoned Mine Drainage Cleanup Plan completed for the Montour Run Watershed assessing and prioritizing major AMD discharges with selected conceptual designs
09/18/03	Growing Greener Grant Awarded to Montour Run Watershed Association for creation of Boggs Road Mine Drainage Remediation System in the amount of $101,766.00 dollars
09/25/03	Montour Run Watershed Association meeting; project update by BioMost
10/28/03	Montour Run Watershed Association meeting; project update by BioMost
11/--/03	"Montour Run Watershed Association" article in Slippery Rock Watershed Coalition's newsletter, *The Catalyst*
11/14/03	Scope of Work, Simplified Budget, and Growing Greener Goals and Accomplishment submitted to DEP
11/23/03	"Montour Run mine water treatment funded with state grant" article in *Pittsburgh Post-Gazette* newspaper
12/16/03	Montour Run Watershed Association meeting; project update by BioMost
12/22/03	US Office of Surface Mining awards $54,000 grant to MRWA
02/--/04	All design and construction contracts executed
03/10/04	"Findlay targets pollution sites" article in *Pittsburgh Post-Gazette* newspaper
Spring 2004	"We've Got a Plan, Stan!" by Tim Danehy & "Funding in hand for two AMD Treatment Facilities" by Stan Sattinger published in *Montour Run Review* Vol. 5, Issue 1
07/20/04	Montour Run Watershed Association meeting; project update by BioMost
07/22/04	Site investigation and wetland delineation conducted by Aquascape and BioMost, Inc.
08/24/04	Montour Run Watershed Association meeting; project update by BioMost
08/25/04	Site visit and review of Restoration Waiver with Kim Bartos from PA DEP conducted by BioMost, Inc. and Aquascape
08/30/04	Environmental Assessment submitted by Aquascape and BioMost to PA DEP for approval

09/28/04	Montour Run Watershed Association meeting; project update by BioMost
09/30/04	PA SPGP-2 approved by US Army Corp of Engineers
10/26/04	Montour Run Watershed Association meeting; project update by BioMost
11/30/04	Montour Run Watershed Association meeting; project update by BioMost
12/14/04	Design of Passive Treatment System completed by BioMost and submitted to OSM and MRWA
12/20/04	Grading Permit Application Submitted to Findlay Township
12/28/04	Montour Run Watershed Association meeting; project update by BioMost
01/25/05	Montour Run Watershed Association meeting; project update by BioMost
03/09/05	AMD Cleanup Plan and Projects presented to Findlay Twp. Supervisors
03/10/05	Grading permit issued by Findlay Township
04/27/05	Montour Run Watershed Association meeting; project update by BioMost
05/24/05	Quality Aggregates moves equipment onsite to begin construction of passive treatment system
05/24/05	Pre-construction meeting - Quality Aggregates, landowner Keith Kropf, BioMost
05/25/05	Montour Run Watershed Association meeting; project update by BioMost
07/18/05	Site inspection and construction meeting - Quality Aggregates, BioMost
07/23/05	Major construction ends
07/28/05 0729/05	Planting with MRWA volunteers, Aquascape, and BioMost; plants from Aquascape's nursery as well as from local wetlands used to vegetate the new wetlands; trees from Aquascape's nursery planted upslope of system
08/04/05	Site inspection and irrigation of trees conducted by BioMost; Aquascape delivers bales for mulch; meeting with landowner
08/25/05	Site inspection and system performance monitoring conducted by BioMost; meeting with members of MRWA and landowner
09/21/05	"Findlay Twp. Cleanup Ceremony" notice in *The Times* newspaper
09/23/05	Site inspection and system performance monitoring conducted by BioMost; Kevin Steiner from Quality Aggregates addresses storm damage to diversion ditch and excavates sediments from the wetland area
09/30/05	MRWA Dedication Ceremony with Keith Kropf, numerous local citizens, State Senator Pippy, PA DEP Greensburg District Office and Southwest Regional Office, US Office of Surface Mining, Browning Ferris Industries, Imperial Land Corp., Quality Aggregates, Aquascape, BioMost, Stream Restoration Inc.
10/05/05	"Montour watershed soon back to normal" article in *Valley Tribune* newspaper
10/07/05	"Abandoned Mine Drainage Treatment Facility Dedicated in Findlay Township" article in *Pennsylvania Environment Digest*
10/08/05	Wetland planting by Montour Run Watershed Association and BioMost, Inc.
10/28/05	Site inspection and system performance monitoring conducted by BioMost
11/21/05	Weir constructed and installed by BioMost
12/--/05	"Montour Run Watershed Association Wetland Planting" article in Slippery Rock Watershed Coalition newsletter, *The Catalyst*
12/02/05	Site inspection and system performance monitoring conducted by BioMost
12/20/05	Site inspection and system performance monitoring conducted by BioMost

TECHNICAL REPORT

Introduction

The 36.6-square mile Montour Run Watershed lies within the Ohio River Basin in western Allegheny County in portions of Findlay, Moon, North Fayette, and Robinson Townships and the Borough of Coraopolis. With the watershed located just south of Pittsburgh, there continues to be significant residential, commercial, and industrial development activities. The Pittsburgh International Airport occupies approximately one-fourth of the watershed. In the PA Department of Environmental Protection 1998 303d list of waters, Montour Run was designated a Category 1 for restoration, having over 26 miles of streams impaired by urban runoff and acid mine drainage (AMD) with unacceptable pH and metals content. The AMD pollution negatively impacts aquatic plants and animals in the headwaters as well as downstream. Currently, benthic macroinvertebrates that once populated these reaches of the Montour Run Watershed are struggling.

The Montour Run Watershed Association (MRWA), formed in 2000 by concerned citizens, has been actively seeking solutions to restore this heavily impaired watershed. In September 2003, the MRWA completed an Abandoned Mine Drainage Treatment Clean-up Plan that was funded by a PA DEP Growing Greener grant. The report identified and prioritized major sources in the watershed and proposed conceptual plans for reclamation efforts based upon potential environmental benefits and overall project feasibility. This report found that the AMD located along Boggs Road on South Fork Montour Run was one of the best candidates for the installation of a passive system, which implements environmentally-friendly technology with the goal of long-term, low-maintenance, treatment of abandoned mine drainage.

A Growing Greener grant from the Pennsylvania Department of Environmental Protection (submitted Feb 2003; awarded Sep 2003) and a grant from the Clean Streams program of the US Department of Interior Office of Surface Mining (submitted Jul 2003; awarded Dec 2003) provided the funding to complete the design and installation of a passive treatment system to abate the SFMU2 mine discharge, which emanates from an abandoned surface mine associated with the Pittsburgh coalbed (Pittsburgh Fm.; Monongahela Gp.).

Site Location

This restoration project is constructed on property owned by Keith & Mary Kropf and Imperial Land Corporation along Boggs Road in Findlay Township and is adjacent to the Browning Ferris Industries (BFI) Imperial Landfill. The project is located on the 7.5-minute Clinton USGS Topographic Map. See Location Map (Figure 1).

Site Preparation

The US Office of Surface Mining completed a General Environmental Assessment and a wavier of permit requirements was received under Pennsylvania Code Title 25, Chapter 105. Aquascape Wetland & Environmental Services conducted the wetland delineation needed to obtain this waiver. The passive system design was completed by BioMost, Inc. and submitted to the US Office of Surface Mining for review. PA One Call relating to underground utilities was contacted. Erosion and Sediment Pollution Controls were installed in accordance to the written plan prepared by BioMost and reviewed by Findlay Township. E&S controls a silt fence barrier below the earth disturbance areas. A grading permit was also prepared by BioMost and approved by Findlay Township. The site was then cleared and grubbed.

Passive Treatment System Installation and Reclamation Effort

The Boggs Road Mine Drainage passive treatment system and reclamation effort includes the following components:

Forebay: The forebay was designed to capture the mine drainage that emanates in a seep zone from the northwestern end of the Boggs Road Mine Drainage Remediation Area. In addition to conveying the discharge to the passive treatment system, the forebay also provides for the settling of debris such as branches and leaves and for the oxidation and precipitation of metals.

Precipitation Pool/Level Spreader: The mine water is conveyed from the forebay by a riprap-lined spillway, which aids in aeration of the water and degassing of carbon dioxide, to a precipitation pool and level spreader. The riprap-lined level spreader was designed to evenly distribute the flow into Bioswale 1 and to discourage development of preferential flow paths and increase retention time.

Bioswale 1 and Bioswale 2: The effluent from the precipitation pool level spreader enters Bioswale 1, which in turn flows into Bioswale 2. The bioswales allow for the formation and settling of particulate iron and convey the flow to the aerobic wetland. Riprap-lined spillways were constructed between each component to aerate the water and degas carbon dioxide dissolved within the mine discharge. Spent mushroom compost (about ½ foot in thickness) was placed as a growth medium for the wetland plants.

Aerobic Wetland: From the bioswales the discharge enters a plunge pool/level spreader to evenly distribute the flow to a horseshoe-shaped aerobic wetland. Spent mushroom compost was mixed with onsite soil material to provide the growth medium (organic substrate) for the wetland plants. The wetland was designed to look and to function as a natural wetland including microtopographic relief and woody debris to enhance the system performance, to encourage plant diversity, and to provide wildlife habitat. The wetland was planted with numerous native species (See Table I for plant list.) by volunteers from the Montour Run Watershed Association. In addition, live Black Willow, Smooth Alder, and Ninebark (many from the Aquascapte nursery) were planted to develop structural diversity and to help provide shade. As the vegetation becomes denser and the substrate becomes more developed, the amount of iron particulates settling within the Aerobic Wetland is expected to increase.

Polishing Wetland/Settling Pond: The effluent from the aerobic wetland is conveyed by a riprap-lined spillway to further aerate the water and encourage additional oxidation of metals before entering into the plunge pool/level spreader at the inlet end of the final polishing wetland/settling pond complex. From the approximately 4-foot deep channel, the flow is evenly distributed, as feasible, to the wetland area with microtopographic relief and woody debris. The water then flows into a larger deeper area (pond) with a water depth of about 6 feet to encourage additional settling of remaining suspended solids. Varying depths of water allowed the polishing wetland to be planted with native species (shrubs, emergents, submergents) to provide a biologically-diverse ecosystem with enhanced wildlife habitat.

Table I. Species Planted in the Wetland and Upland Areas

Common Name	**Scientific Name**
Coontail	*Ceratophyllum demersum*
Smartweed	*Polygonum Pennsylvania*
Rice Cutgrass	*Leersia oryzoides*
Bladder Sedge	*Carex intumescens*
Umbrella Sedge	*Cyperus strigosus*
Beaked Spike Rush	*Eleocharis rostellata*
Wool Grass	*Scirpus cyperinus*
Soft Stemmed Bulrush	*Scirpus validus*
Soft Rush	*Juncos effuses*
Sweet Flag	*Acorus calamus*
Eastern Bur-reed	*Sparganium americanum*
Arrowhead	*Sagittaria latifolia*
Northern Water Plantain	*Alisma plantago-aquatica*
Ironweed	*Vernonia noveboracensis*
Boneset	*Eupatorium perfoliatum*
Joe-Pye-weed	*Eupatoriadelphus fistulosus*
Black Willow	*Salix negra*
Red Osier Dogwood	*Cornus sericea*
Button Bush	*Cephalanthus occidentalis*
Smooth Alder	*Alnus serrulata*
Ninebark	*Physocarpus opulifolius*
Black Locust	*Robinia pseudoacacia*
Green Ash	*Fraxinus pennsylvanica*
Quaking Aspen	*Populus tremuloides*
Smooth Sumac	*Rhus glabra*

Weir: A 90º V-notch weir was constructed in the final effluent spillway of the passive treatment system to enable monitoring of flow rates and to reestablish the permanent water monitoring sampling point for the Montour Run Watershed Association. The weir was constructed in the same approximate location as the previous existing weir and will continue to be identified as sampling point SFMU2.

By-Pass System: A by-pass system consisting of several strategically-placed pipes with valves was installed throughout the passive treatment system to allow the water to by-pass various components. (The idea for the by-pass system was contributed by John Davidson, former MCI, Greensburg District Mining Office.) This by-pass system will allow for efficient future maintenance activities such as removal with possible resource recovery of iron precipitates.

Upland Area: The upland area was revegetated with a seed mix including Birdsfoot Trefoil, White Dutch Clover, Kentucky Bluegrass, and Perennial Rye. About 25 trees were planted on the uphill slope, including Green Ash, Hybrid Popular, Big Toothed Quaking Aspen, Black Locust, and Smooth Sumac. In addition, woody herbaceous plants were placed throughout the project area on the embankments of the passive system near the water level in suitable habitat locations. Some of these plants included Nine Bark, Black Alder, Spice Bush, and Red Osier Dogwood.

Passive Treatment System Performance, Environmental Results, and Future Work

The Boggs Road Mine Drainage Remediation System has been online and functional since July 2005. Site inspections and water quality monitoring of the treatment system has been conducted by BioMost, Inc., on a monthly basis, since August 2005. The results, therefore, must be considered preliminary when considering the design life of the system to be 25 years. Table II, as well as Figures 2 and 3, identify the water quality characteristics through each component from the influent (149-1) to the final effluent discharge (SFMU2).

Table II. Water Quality through the Boggs Road Passive Treatment System

Component	Field pH	Lab pH	Field Alkalinity	Lab Alkalinity	Lab Acidity	Fe	Mn	SO_4
149-1 (raw influent)	6.2	6.1	155	104	21	86	8	1224
Forebay	6.3	6.2	119	52	66	95	9	1548
BSWL1	6.9	6.2	83	20	53	73	10	1423
BSWL2	6.4	6.4	90	52	-10	36	11	1380
WL	6.8	6.5	49	36	-1	14	11	1548
SFMU2 (final effluent)	7.3	6.9	36	33	-4	2	10	1562

Average values; 149-1 pre- and post-construction data; SMU2 post-construction only; average pH values not determined from H-ion concentrations; alkalinity and acidity as mg/L $CaCO_3$; iron (Fe) and manganese (Mn) concentrations as dissolved metals in mg/L; sulfates (SO_4) in mg/L; (See monitoring sheets for more details.)

Overall, the passive system appears to be functioning better than expected. The raw mine discharge (149-1) can be characterized as a discharge with significant bicarbonate alkalinity, high concentrations of dissolved ferrous iron, elevated concentrations of dissolved manganese, and low concentrations, as expected, of dissolved aluminum. The final effluent of the treatment system can be described on average as net alkaline with low dissolved iron concentrations, but still containing elevated dissolved manganese concentrations. Much of the alkalinity (~80%) contained within the 149-1 mine discharge is consumed during the formation of iron solids by hydrolysis.

Approximately 98% of the dissolved iron in the discharge is forming particulates within the system.

Manganese and sulfate concentrations, however, appear to actually increase indicating that additional mine drainage seeps may be entering the passive system. Encountering additional seepage during construction of a passive treatment system in a discharge zone is a common occurrence. While the elevated manganese concentrations in the final effluent are not a major concern, the passive treatment system could have benefited from having a Horizontal Flow Limestone Bed (HFLB) to remove manganese and to provide an alkalinity boost to the final effluent discharge. An HFLB was not installed due to limited construction space and funding. Based on the existing effluent characteristics demonstrating a low ferrous concentration, a portion of the manganese is expected to form solids readily and precipitate on the substrate within the watercourse.

As the new weir was not installed until late November 2005, only limited post-construction flow measurements are available to conduct a loadings analysis of the system. By using both the available pre- and post-construction data, however, the annual reduction in iron loading to South Fork Montour Run is estimated to be about 8,000 to 10,000 lbs (4 to 5 tons).

As the first abandoned mine drainage abatement project implemented within the Montour Run Watershed, the Boggs Road Mine Drainage Remediation System has served and will continue to serve as an excellent education/outreach tool for students as well as the local community to learn about AMD and passive treatment. The success at this site will hopefully serve to inspire and to promote future restoration efforts within the watershed. Additional restoration efforts will need to be completed in order to restore Montour Run to a healthy aquatic ecosystem. Funding has already been received for three additional projects that are in various stages of development to address the Clinton Road, NFMU9, and SFMD7 abandoned mine discharges.

The MP6 abandoned mine discharge, which is in close proximity to the Boggs Road site, is the next logical step within the South Fork Montour Run subwatershed. The final effluent of the Boggs Road passive system could be used to provide pre-treatment of the MP6 mine discharge. In addition, a passive system for the MP6 discharge could provide additional treatment for the SFMU2 discharge such as manganese removal through the installation of a Horizontal Flow Limestone Bed. Other high priority discharges that were identified in the AMD Cleanup Plan, and are under consideration for future restoration projects, include MKR3 and MP2.

PROJECT LOCATION - USGS 7.5' CLINTON, PA (1998)

BOGGS ROAD MINE DRAINAGE REMEDIATION SYSTEM

Montour Run Watershed Association

Findlay Township, Allegheny County, PA

Janurary 2006, Scale 1" = 2000'

BioMost, Inc., Cranberry Twp., PA

Approximate Center of Project (deg-min-sec)
40-26-25 latitude 80-17-09 longitude

1000 0 1000 2000

1491119/Loc Map

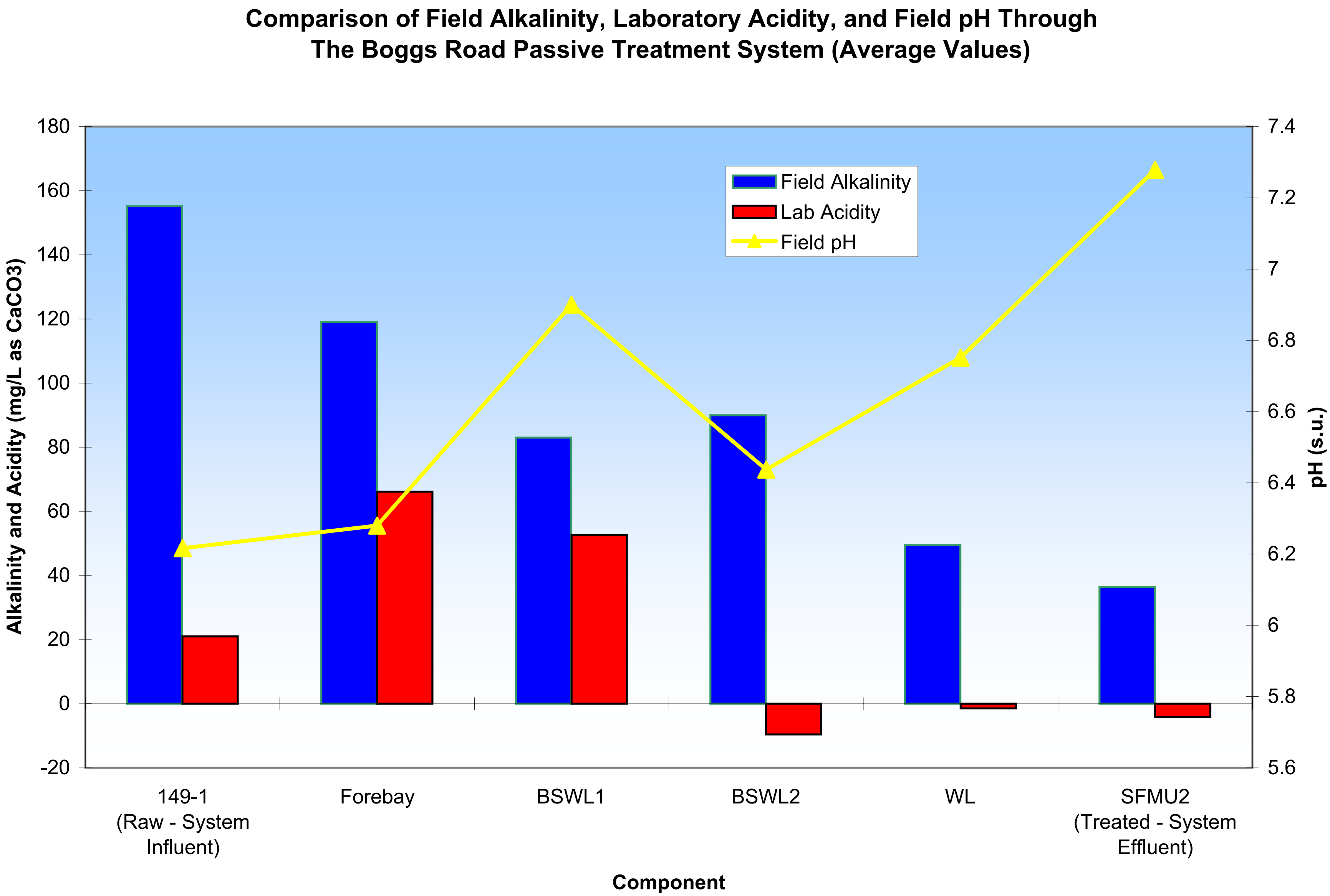

Comparison of Field Alkalinity, Laboratory Acidity, and Field pH Through
The Boggs Road Passive Treatment System (Average Values)
Field Alkalinity
Lab Acidity
Field pH
Alkalinity and Acidity (mg/L as CaCO3)
pH (s.u.)
180
160
140
120
100
80
60
40
20
0
-20
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
149-1
(Raw - System
Influent)
Forebay
BSWL1
BSWL2
WL
SFMU2
(Treated - System
Effluent)
Component

Figure 2

Comparison of Dissolved Metal Concentrations Through The Boggs Road Passive Treatment System (Average Values)

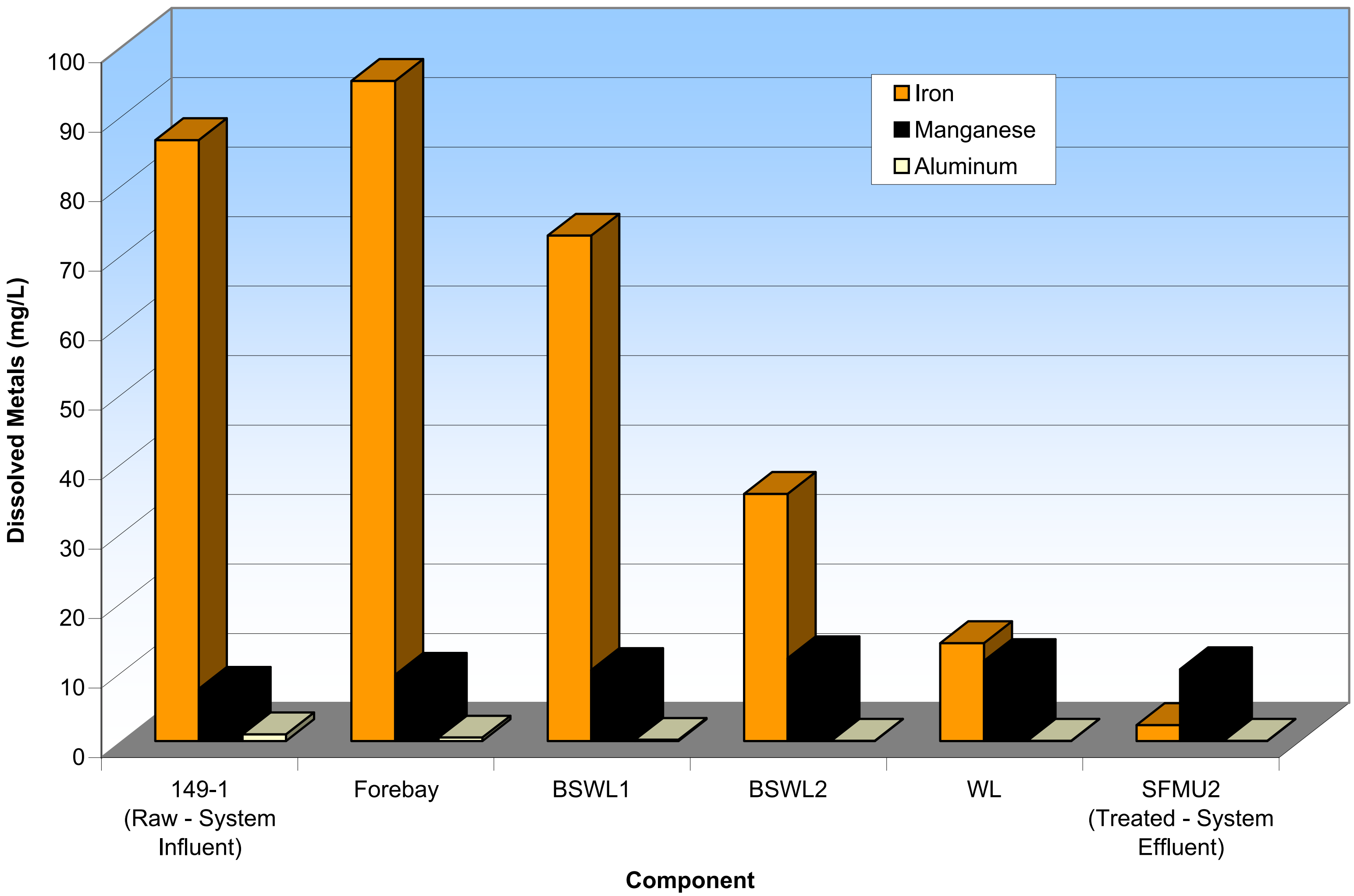


Figure 3

Pre-construction Planning and Assessment

Above: Views of the SFMU2 abandoned mine discharge prior to construction of the passive treatment system. Seen also are personal from BioMost, Inc., Quality Aggregates Inc., and Aquascape Wetland & Environmental Services during site investigations and Environmental Assessment.
Top right: John Stoops (Quality Aggregates); Margaret Dunn (BioMost); Bob Beran, Dave Jessloski (Aquascape).
Middle left and right: photos by John Davidson.
Bottom left: Carl Mathias (Aquascape).
Bottom right: Jeff Reidenbaugh and intern Maggie Tilson (Aquascape).

Excavation & Construction of System






Photographs of Quality Aggregates Inc. constructing the passive treatment system. The excavator and rock truck are removing excess fill while the bulldozer builds and compacts the berms.

Montour Run Watershed Association Wetland Planting






Pictured above is an Education Outreach Day sponsored by the Montour Run Watershed Association. Members of the watershed association and local volunteers conducted a wetland planting. Individuals on hand that day included John Davidson, Stan Sattinger, Libby & Jon Pavlakovich, Donna Rosser, Donna Walker, Dan Campbell, Shaun Busler, Tim Danehy and landowner Keith Kropf.
(10/08/05)

Wetland Planting (continued)

Pictured above is a 07/28-29/05 wetland planting conducted by Aquascape Wetland Environmental Services and BioMost, Inc.
Top left: Adam Craig, Jennifer Hazen, Michael Friedl (Aquascape).
Top right: Jenifer Hazen, Adam Craig (Aquascape).
Bottom left: Adam Craig, Michael Friedl, Jennifer Hazen (Aquascape).
Bottom right: Shaun Busler (BioMost) and Mark Fedosik (MRWA).

Dedication

A dedication ceremony was held on Sept. 30, 2005. Pictured to the left are (L-R) Ed Nelson, Mark Fedosik, Senator John Pippy, Stan Sattinger, Margaret Dunn, Donna Rosser, and Tim Danehy. Among the many in attendees that day were numerous members from the Montour Run Watershed Association, the PA DEP, US Office of Surface Mining (Dave Hamilton), the Kropf family (landowners), BFI Imperial Landfill representatives, and interested local citizens.

Panoramic View of Passive Treatment System

<u>Post-Construction</u>

Views of the passive treatment system vegetation during post-construction site inspections conducted by BioMost, Inc. personnel Shaun Busler **(Top left)** and Tim Danehy **(Top right)**.

Post-Construction (continued)

Top left: (L-R) John Davidson, Donna Walker, Keith Kropf, and Guy Kropf inspecting the passive treatment system shortly after completion.
Top right: Weir installed in the final spillway below the final pond (current SFMU2 monitoring point).
Bottom: Panoramic view of the Boggs Road Passive Treatment System after new vegetation has become established.

OPERATION AND MAINTENANCE PLAN

This is the Operation and Maintenance Plan for the Boggs Road Mine Drainage Treatment System located near the headwaters of South Fork Montour Run in Findlay Township, Allegheny County, Pennsylvania. This project is constructed along Boggs Road on property owned by Keith & Mary Kropf and Imperial Land Corporation. [Browning Ferris Industries (BFI) operates Imperial Landfill on the Imperial Land Corporation property.] The confluence of South Fork and North Fork Montour Run, approximately 2.5 miles downstream of the project area, form the main branch of Montour Run (a stocked trout fishery). Several other tributaries enter Montour Run prior to the confluence with the Ohio River in the Borough of Coraopolis.

This passive treatment system consists of a forebay with level spreader, which collects the discharge emanating from a seep zone below an abandoned surface mine on the Pittsburgh coalbed, one large diverse aerobic wetland complex with a series of riprap-lined spillways and a “polishing” pond area, and a weir which has been set near the outlet of the final spillway for monitoring purposes. The treated mine drainage is then returned to a pre-existing channel, which empties to the South Fork Montour Run.

The Montour Run Watershed Association will perform maintenance on the passive system as needed in order to maintain treatment function. This AMD treatment system was designed based on the best available knowledge and technology at the time and was implemented through a public-private partnership effort spearheaded by the Montour Run Watershed Association (PA non-profit). It must be recognized that the technology of passively treating AMD is relatively new. All structures were designed focusing on minimal operation and maintenance compared to conventional treatment systems. In order, however, for these facilities to effectively treat the mine drainage, periodic inspections and maintenance are needed. Inspection report forms, site plan schematic with monitoring points identified, and a location map are provided in sheet protectors within this report to allow for ease in copying for field use.

This Operation and Maintenance Plan has been developed and written for use by the general public.

For questions regarding implementation of the O & M Plan, contact

BioMost, Inc.
3016 Unionville Road
Cranberry Twp., PA 16066
Phone: 724-776-0161
Fax: 724-776-0166
bmi@biomost.com

CONTENTS

PASSIVE TREATMENT SYSTEM PROJECT OVERVIEW

Passive systems use no electricity, require limited maintenance, and use environmentally-friendly materials for treatment, such as limestone aggregate and spent mushroom compost. These systems provide a cost-effective alternative to the harsh chemicals typically used for conventional treatment of mine drainage. Passive systems can be designed to neutralize acidity and add alkalinity while providing an environment suitable for beneficial chemical reactions and biological activity. Alkalinity encourages the metals dissolved in the mine drainage to form particulates, which are then retained in channels, settling ponds and/or constructed, naturally-functioning, wetlands. In some cases, the mine discharge contains sufficient alkalinity such that no alkalinity-generating processes are needed, which is the case at the Boggs Road Mine Drainage Remediation System.

There are several main types of passive treatment components that can be used, often in series, to treat degraded mine drainage. These components are chosen based upon the drainage characteristics (quality and flow rate), chemical or biological reaction preferred, and available construction space. The following is a brief description of the Boggs Road Mine Drainage Remediation System components.

Forebays: (right) can serve multiple purposes. They can be used to convey water, provide for settling of debris, and allow for oxidation, precipitation, and accumulation of metal solids. There is one Forebay at the Boggs Road Mine Drainage Remediation System. The Forebay captures the water from the pre-existing abandoned mine drainage seep zone. The Forebay outlet spillway to the first wetland (Bioswale 1) "agitates and aerates" the drainage to further encourage formation of metal solids.

Wetlands: (left) are typically used in passive treatment systems to allow for the oxidation, precipitation, filtering, and accumulation of metal solids that occur when alkaline drainage issues from a mine site or after acidic drainage has passed through an alkalinity-generating component. Although many treatment wetlands are angular-shaped shallow ponds with predominantly cattails, the wetlands at this site have been designed, built, and planted to look and function as natural wetlands with high species diversity to provide not only treatment but also wildlife habitat. One large diverse aerobic wetland complex was designed and comprises the majority of the Boggs Road Mine Drainage Remediation System.

SITE SPECIFIC INSTRUCTIONS

Everyone who will be involved in the operation of the site should have an understanding of, and the ability to perform, basic routine duties, such as site inspections that include evaluating channels, spillways, and passive treatment components as well as water sampling and measuring flows.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

To maintain the effectiveness of the passive treatment facility, the site should be inspected at regular intervals and after major precipitation events or other natural/manmade occurrences that may affect the performance or integrity of the system. Regular site inspections should be conducted on a quarterly basis for the first two years and at least annually thereafter. A qualified person should perform the inspection and complete the appropriate report(s). (See attached inspection report forms.) The inspector should keep the paper copy of the report in permanent files in chronological order at a designated location. If desired, “Datashed” can be utilized to report and to store data on a GIS-enabled database online via the website www.datashed.org.

The report should include the inspection date, the inspector’s name, the organization with which the inspector is affiliated, and the start and end time of the actual inspection. The following sections correspond with the attached Passive Treatment System O&M Inspection Report.

A. Site Vegetation (Uplands and Associated Slopes)

Vegetation (i.e. groundcover) is extremely important to provide wildlife habitat and to prevent erosion. Erosion can carry sediment into streams resulting in turbidity and siltation. Sediment entering the passive components can cause loss of capacity. During inspection, overall condition of the site vegetation should be observed and numerically rated from 0 to 5. If significant areas are barren, describe the action needed as well as the location. Normal husbandry practices (such as fertilizing, seeding, mulching, removing unwanted species, etc.) should be implemented, as necessary, to maintain a stable non-erosive groundcover and viable wildlife habitat on the site.

Rating	Description	Recommended Action
0	Site barren	Revegetate as soon as practicable; temporary seeding, installation of staked straw/haybales, filter fabric, etc. may be necessary until stabilization with permanent approved seed mix
1	Site mostly barren. Only small isolated areas of vegetation present	(Same as for “0” rating)
2	Large area(s) barren	Outline general area(s) on Site Schematic; revegetate as described for “0” rating
3	Revegetation spotty; erosion gullies present	Outline general area(s) on Site Schematic; on poorly vegetated areas, seed, mulch, apply soil amendments, as needed; install staked straw/haybales, rip-rap, etc. in gullies to control erosion
4	Successful vegetation >70% groundcover; few, isolated, minor erosion features or areas with spotty vegetation	Identify potential problem areas; note changes on future Inspection Reports
5	Successful vegetation >70% groundcover	No remedial action required

B. Access and Parking Area

A 4WD access road to upper area of the site has been constructed from the BFI Imperial Landfill entrance roadway. Non off-road capable vehicles can park off to the side of the BFI entrance roadway. Alternatively, the site may be accessed from Boggs Road, however, care should be taken because this is a private residential area owned by Keith and Mary Kropf.

On the inspection sheet:

- Stabilized, graded area accessible (Yes or No): Is there debris or trash? Are significant erosion gullies present?
- Maintenance required: Do portions need to be stabilized? If so, identify area on Site Schematic. Is machinery required to remove debris?

C. "Housekeeping"

The Boggs Road Mine Drainage Remediation System is located on private property owned by Keith & Mary Kropf and Imperial Land Corporation. They have allowed this facility to be constructed on their property in order to help restore Montour Run. Please collect any litter you see during your inspection and dispose of it properly. Do not touch anything that you feel may be dangerous (such as, broken glass) or hazardous. Note these items and their location as a comment in the inspection report and make arrangements to have the material removed using appropriate methods.

D. Vandalism

Please record any type of vandalism and evidence of trespassing on the inspection report. Note any damage to the passive treatment system.

E. Diversion Ditches, Channels, and Spillways

All diversion ditches, channels, and spillways should be inspected and maintained to minimize erosion and insure proper water handling. The channels should be kept free of obstructions that would restrict water flow. Any debris/obstructions should be removed. Vegetation should be removed from spillways if a "dam" is being created and causing the water level to be significantly raised in the component. The channels should also spread the flow to the maximum extent practical to help aerate the drainage, if concentrated channeling is developed, riprap should be rearranged to promote a broad flow path. If disturbed or eroded areas are present, then these areas should be stabilized as soon as possible with riprap or noninvasive plant species, as appropriate. Channels or ditches that carry mine drainage should be cleaned when accumulated material reduces the capacity by about one half.

On the inspection sheet, for each identified channel or spillway note:

- Significant erosion present (Yes or No): Is the riprap or vegetative lining impaired or absent? Has the berm been overtopped and/or breached? Is there significant sedimentation as a result of erosion?

- Significant debris present (Yes or No): Are there tree limbs, leaves, trash, etc. that would “dam” the water in the diversion ditches and collection channels? Are there vegetation and/or debris in the riprap-lined spillways that would cause the water level to rise in the passive components?
- Maintenance performed: Have the plants been removed from the riprap-lined spillways? (Removal of plants from riprap-lined spillways on a regular basis as part of “general housekeeping” prevents overtopping of berms and loss of function of the facility.) Have tree limbs, leaves, trash, etc. been removed? Has the erosion been addressed (rocks placed in erosion features; sediment cleaned from ditches, dirt placed and compacted on berms of ditches and channels, etc.)? Have concentrated flows been abated by strategic riprap placement?
- Maintenance remaining: Describe additional maintenance needed. Indicate areas for additional maintenance on the Site Schematic.

F. Passive Treatment System Components

All passive treatment components need to be inspected for erosion, berm (slope) stability, vegetation, siltation, leaks, etc. Any problem should be noted and corrected as soon as practicable.

Also during site inspections, the condition of the vegetation and the presence of any disturbed or eroded areas should be noted. Significantly disturbed or eroded areas should be stabilized as soon as possible with staked straw/haybales, riprap, plantings with accepted species, etc., whichever is appropriate.

On the inspection sheet, for each identified passive treatment component note:

- Significant erosion present (Yes or No): Are erosion gullies on the inside and/or outside of the berms?
- Features relating to berm instability present (Yes or No): Is there any slumping noted? Are tension cracks visible?
- Successful vegetation (Yes or No): Are there significant areas on the inside and/or outside berms that need to be revegetated? Overall, does the vegetation appear healthy?
- Significant siltation/sedimentation present (Yes or No): Is there significant sediment from erosion of berms or upland areas accumulating in the passive component?
- Significant change in water level (Yes or No): Is the water level rising or lowering in the passive component? Is the water level appropriate (not too high or too low) for the plants in the wetlands?
- Maintenance required: Do portions of the berms need to be stabilized with riprap and/or reconstructed? Does supplemental reseeding and mulching need to be completed? Do any passive components need to be cleaned of sediment?

G. Wildlife Utilization

One of the functions of a constructed wetland is to provide wildlife habitat for desired species. If, however, during inspections, signs of damage are noted, such as from muskrats, appropriate steps should be taken to continue the function of the passive system and general site restoration. Significant damage needs to be corrected by repairing berms, removing invasive species, replanting, and trapping (contact PA Game Commission).

On the inspection sheet:

- Animals observed: Although not an inventory, please record tracks or visual observations of wildlife utilizing the site. Describe any damage observed.
- Invasive plants observed: If invasive or undesirable plants are observed, please note and remove as soon as practicable.

H. Flow Measurements:

Flow rates can be measured at the SFMU2 weir using either an engineer's rule or a bucket and stopwatch method as the water flows over the weir.

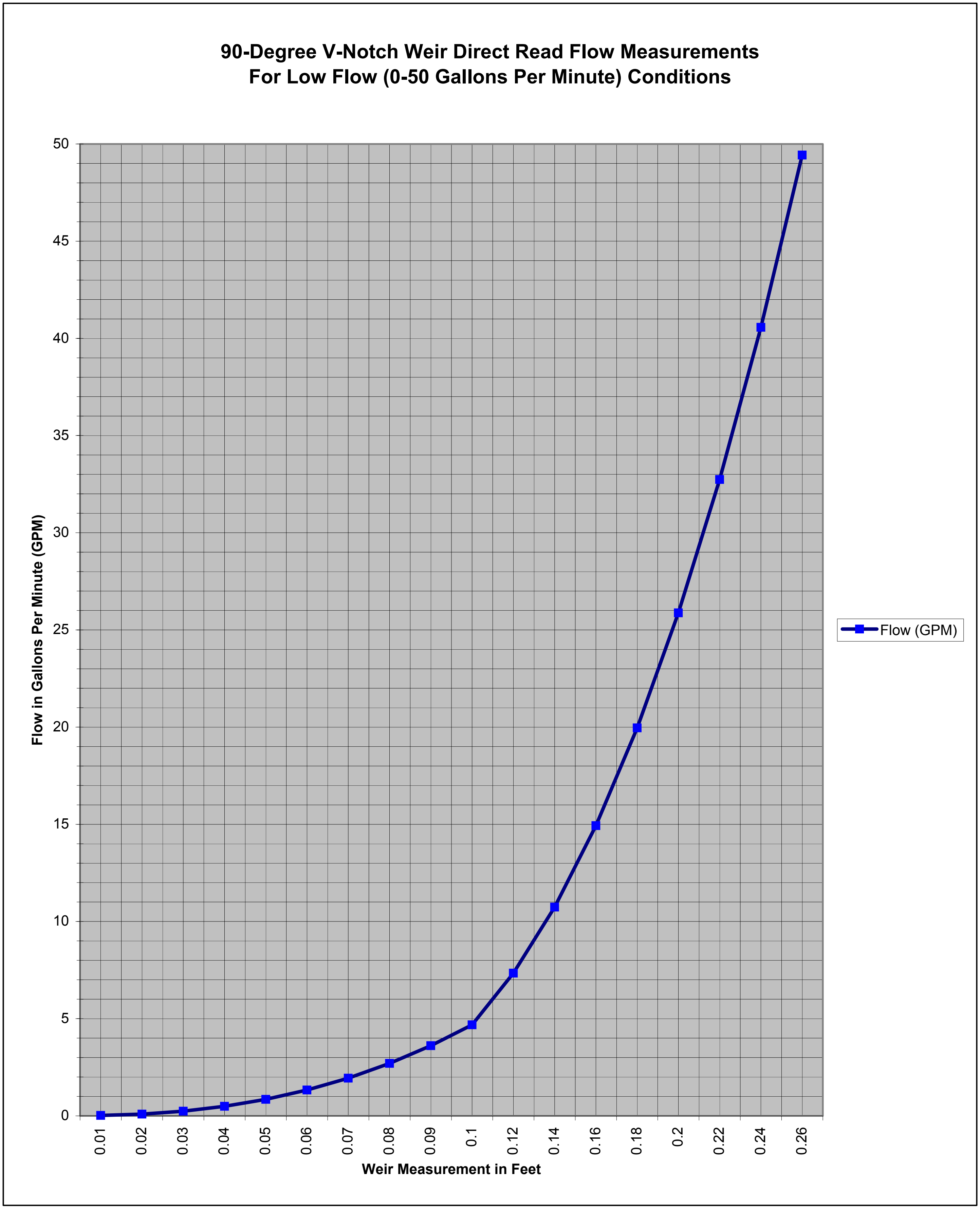
Weir Measurement with Engineer's Rule
(tenths and hundredths of feet)
(Note: table and graphs do not include inches)

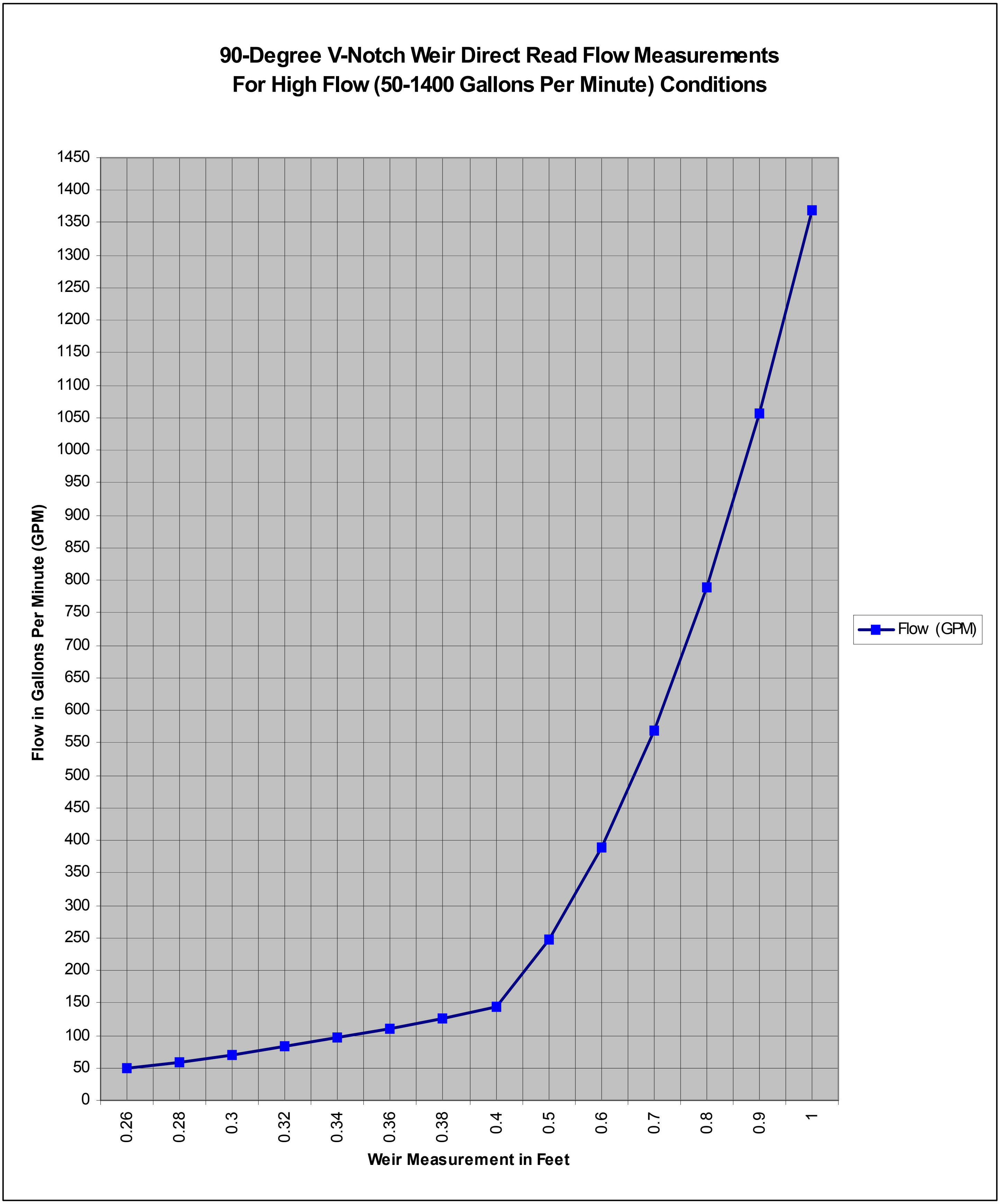
In order to measure the flow rate at the weir, place an engineer's rule in the middle of the base of the V-notch. Read the depth in tenths of a foot of water flowing through the notch. Use the measurement with the below table or graphs on the following page to determine the flow rate. The table and graphs are based on a non-conventional equation developed for direct read of weir measurements to simplify the monitoring process.

Measurement (ft)	**Flow** (gpm)	**Measurement** (ft)	**Flow** (gpm)	**Measurement** (ft)	**Flow** (gpm)
0.01	0.02	0.14	11	0.36	110
0.02	0.1	0.16	15	0.38	126
0.03	0.2	0.18	20	0.40	143
0.04	0.5	0.20	26	0.50	247
0.05	0.9	0.22	33	0.60	389
0.06	1.3	0.24	41	0.70	568
0.07	1.9	0.26	49	0.80	790
0.08	2.7	0.28	59	0.90	1056
0.09	3.6	0.30	70	1.00	1370
0.10	4.7	0.32	82		
0.12	7.3	0.34	96		

Weir Maintenance

In order to continue measuring flows accurately, the weir must be maintained. The weir must be kept as level as possible, both horizontally and vertically, to ensure accuracy of flow measurements. Leaking around or under the weir will also result in inaccurate flow measurements. Metal precipitates, sediment, leaves, and other debris should be removed from the V-notch prior to measurement. The area behind the weir should also be cleaned if the pool becomes filled with sediment and debris. When removing debris or sediment from the pool or weir, sufficient time should be allowed for the water level to equilibrate before taking a flow measurement.


90-Degree V-Notch Weir Direct Read Flow Measurements
For Low Flow (0-50 Gallons Per Minute) Conditions
Flow in Gallons Per Minute (GPM)
50
45
40
35
30
25
20
15
10
5
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
Weir Measurement in Feet
Flow (GPM)


90-Degree V-Notch Weir Direct Read Flow Measurements
For High Flow (50-1400 Gallons Per Minute) Conditions
Flow in Gallons Per Minute (GPM)
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4
0.5
0.6
0.7
0.8
0.9
1
Weir Measurement in Feet
Flow (GPM)

Bucket and Stopwatch

Flow measurements at the weir and pipes can be made using a bucket and stopwatch. The bucket and stopwatch method consists of timing (in seconds) the filling of a bucket of known volume (preferably calibrated in gallons). The flow rate in gallons per minute can then be calculated utilizing the following formula:

$$\textbf{Flow (gal/min)} = \left(\frac{\textbf{Gallons}}{\textbf{Seconds}}\right) \times 60$$

A bucket can be calibrated by using another container of known volume to add measured amounts of water to the bucket to be calibrated. Gradations (lines) can then be drawn with a permanent marker to connote the volume of water in gallons. For a 5-gallon bucket, gradations 1, 2, 3, 4, and 5 gallons should be used. For a larger bucket such as a 20-gallon bucket, gradations such as 5, 10, 15, 16, 18, and 20 or similar should be used.

I. Water Monitoring and Sample Collection

In order to assess the efficiency and performance of this system and to satisfy requirements for the US Army Corps of Engineers (addressed later in this report), field tests should be completed including pH, temperature, alkalinity, dissolved iron, and dissolved manganese. Water samples, to confirm field analyses, may also be taken and analyzed by the PA State Lab or other approved laboratory using standard chemical testing procedures for pH, alkalinity, acidity, total and dissolved iron, and total manganese. (Additional parameters are optional.)

Water sampling and field testing at the following locations will enable evaluation of the degree of success of the passive components, individually and combined, in treating the mine drainage and of the quality of the receiving stream, South Fork Montour Run.

POINT	DESCRIPTION	LOCATION	MONITORING PROGRAM			
			RECOMMENDED		REQUIRED (Army Corps)	
			years	frequency	years	frequency
149-1	Raw water(influent)	Forebay spillway	2006 -2007	quarter		
			2008 →	biannual		
SMFU2	Treated water(effluent)	WL/Pond spillway weir	2006 -2007	quarter	2005 -2010	annual
			2008 →	biannual		
S-24	So. Fork Montour Run	~1000' below system	2006 - 2009	annual	2005 -2010	annual
			2009 →	optional		

The monitoring program may include other points within the passive treatment system in order to provide a complete description of the water quality through the various components at the time of sampling. Optional monitoring point locations are identified on the O&M Inspection Sheet, site schematic, and "As-Built" plans.

In order to conduct laboratory analyses for pH, alkalinity, and acidity (optional: sulfates and total suspended solids), a 500-ml (or other specified volume), unfiltered, sample should be collected, stored in a cooler, and transported to the laboratory. In order to differentiate between dissolved and total metals concentrations, the laboratory requires two, 125-ml (or other specified volume) samples that are preserved with trace metal-grade nitric acid to ensure that the pH is <2. The sample for total metals is not filtered. The sample for dissolved metals is filtered using a 0.45-

μm filter in the field prior to placing the sample in the bottle. The filtering device should be rinsed with distilled or de-ionized water between each sample. Each bottle is to be labeled with a unique number.

A record of every sample should be made directly on the inspection sheet. Information such as sampler's name, location, date, flow rate, field tests, and sample bottle identification is written on the inspection sheet. Pertinent information is then transferred from the inspection sheets to the laboratory's Record-of-Sample Form or Chain-of-Custody Form.

On the inspection sheet for each Sampling Point:

- Field measurements:

Parameter	Method
Flow rate	Weir or Bucket & Stopwatch
pH	HACH pH kit, pH meter, etc.
Temperature	Field thermometer, pH meter, etc.
Alkalinity	HACH Digital Titrator, etc.
Iron	HACH iron kit, etc.
Manganese	HACH manganese kit, etc.
Dissolved oxygen (optional)	HACH DO kit, DO meter, etc.

Record readings to nearest whole number, except pH (record to nearest tenth).

- Sample bottle data: If water samples for laboratory analysis are collected, assign and record bottle numbers on the inspection sheet. You will need to transfer this information to the laboratory's Record-of-Sample or Chain-of-Custody Form.

- Comments: Observations such as sample color or other information may be recorded in the "Comments" column.

J. Schematic

A site schematic, provided to orient the inspector, is keyed to the various sections of the inspection report. The schematic can also be used to identify specific locations where maintenance is needed. For instance, if a section of the site was not well vegetated and experiencing erosion, that area could be circled on the schematic and then a copy or fax could be provided to the person(s) responsible for addressing the issue.

US ARMY CORPS OF ENGINEERS REPORTING

As specified in a letter dated 9/30/04, as a special condition by the US Army Corp of Engineers (USACE) for federal approval of PA DEP Joint Permit Waiver #16 request for a PA State Programmatic General Permit (PA SPGP-2), the MRWA will be required to complete and send to the USACE an annual water quality monitoring report for a period of five years. This report should be sent in February of each year through the year 2010. The report must identify total iron and manganese concentrations at a monitoring point just below the effluent from the system (SFMU2) and at a monitoring point on South Fork Montour Run (S-24), approximately 1000 feet downstream of the system effluent. A sample form letter has been included with this O&M plan.

MISCELLANEOUS MAINTENANCE CONSIDERATIONS

All materials used in repairs should be of equal or better quality and have the same capacity and function as shown on the “As-Built” plans.

By-Pass System

A By-Pass System consisting of three strategically placed pipes and valves were installed at the site (See “As-Builts” or Schematic.) that allows water to by-pass various components by opening a specific valve. This control of the water allows for maintenance such as rebuilding berms or removal of the iron sludge for resource recovery or disposal. By opening the valves the following by-pass conditions can be created:

By-Pass Location (piping and valve)	Components By-Passed
Forebay → upper By-Pass Channel	Precipitation Pool; BSW1; BSW2
Forebay and upper By-Pass Channel → lower By-Pass Channel	Precipitation Pool; BSW1; BSW2; WL
WL inlet → WL/Pond	WL and wetland portion of WL/Pond

Removal and Disposal of Accumulated Precipitate or Sediment

Precipitates from chemical reactions and other solids will be retained within the forebay and wetlands. This sludge should be removed when the volume of the component is reduced by one half. Inlet and outlets should be kept clear of debris and obstructions. Sludge removal is planned for every fifteen years or as needed. Opportunities may be available to utilize the sludge for metal recovery or the sludge may be allowed to drain/dewater for disposal. At this time, the sludge from coal mine drainage does not require special permitting for disposal. Care, however, should be taken in order not to cause sediment problems in streams. (If needed, an Erosion and Sediment Pollution Control Plan should be completed for the placement area.)

SLUDGE ACCUMULATION REPORT
(Optional)

A sludge accumulation inspection may be completed every year or every other year, as desired. The primary purpose of this inspection is to assess the type and amount of sludge that is accumulating within the passive treatment components. This can give an indication as to how the system is functioning and when action is needed to remove the sludge from the component.

On the inspection sheet for each component listed provide:

- Sludge Accumulation: Note the depth (estimated) of the sludge. Has the sludge filled the component to within about 1-2’ of the primary spillway or top of berm in the wetlands?
- Sludge Description: Note the color of the sludge. Typically, white, red, and black colors indicate precipitate rich in aluminum, iron, and manganese, respectively.
- Comments: For example: Is there significant organic debris in the sludge?

WETLAND PLANT DIVERSITY REPORT
(Optional)

It may also be desirable that a Wetland Plant Diversity Report be completed once per year. The primary purpose of this report is to assess the diversity of plant species within the constructed treatment wetland in order to determine if species diversity is increasing or decreasing. Species diversity is believed to optimize the health, productivity, and treatment capability of the wetland. In addition, increased plant species diversity should result in an increase in wildlife diversity. A secondary purpose is to identify if unwanted invasive plants have become established, such as common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). (See pictures below.) These plants should be removed. On the report provide the common and/or scientific plant name, plot number and location and the population within that plot.

Common Reed

Purple Loosestrife

REPLACEMENT

All passive treatment systems are unique. The sludge storage capacity for a projected design life of 25 years was based upon background monitoring data and published references. Higher flow rates and poorer water quality can substantially affect the design life. When the storage capacity of the system has been diminished by approximately one half, the sludge should be removed. Prior to removal, the system and water quality should be evaluated to determine if reconstruction of the system is necessary. Advances in technology and changes in raw drainage quality and quantity should be considered to determine if revisions to the size and/or design of the system would be advantageous. Replacement considerations include:

(1) Estimating Best Management Practice (BMP) design life;
(2) Determining replacement responsibility, including a successor, as necessary;
(3) Determining approximate costs for removing accumulated sediments, replacing water control structures, re-sizing system to accommodate changed water quality or quantity, and replanting wetlands.

PASSIVE TREATMENT SYSTEM O&M INSPECTION REPORT

12/2005

Inspection Date:	______________	Project Name:	**Boggs Road Mine Drainage Remediation System**
Inspected by:	______________	Municipality:	**Findlay Township**
Organization:	______________	County:	**Allegheny** State: **PA**
Time Start: ________	End: ________	Project Coordinates:	**40° 26' 25''** Lat **80° 17' 09''** Long
Receiving Stream:	**South Fork of Montour Run**	Subwatershed: **Montour Run**	Watershed: **Ohio River**

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny **Temp(°F):** #32 33-40 41-50 51-60 60+

Is maintenance required? Yes/No If yes, provide explanation: ______________________________

____

____

INSPECTION SUMMARY

A. Site Vegetation (Uplands and Associated Slopes)

Overall condition of vegetation on site: 0 1 2 3 4 5 (0=poor, 5=excellent, circle one) (See instructions.)

Is any reseeding required? Yes/No If yes, describe area size and identify location on Site Schematic: ______________

B. Access and Parking Area

Is the access road accessible for operation and monitoring? Yes ☐ No ☐
Does the access need maintenance? Yes ☐ No ☐
Describe maintenance performed and remaining (Identify location on Site Schematic.): ______________

____

____

C. & D. "Housekeeping" and Vandalism

Is there litter along the road? Yes ☐ No ☐ Is there litter around or in the passive system? Yes ☐ No ☐
Is there litter or other materials that may be considered hazardous or dangerous that requires special disposal? Yes ☐ No ☐
Is the weir at the final spillway damaged or missing? Yes ☐ No ☐ Is the weir functioning as it should? Yes ☐ No ☐
Does the weir need to be repaired or replace? Yes ☐ No ☐ Has the weir been repaired or replaced? Yes ☐ No ☐
Additional comments: ______________________________

E. Diversion Ditch, Channels, and Spillways

Channel Identification	Significant Erosion (Y/N)	Debris Present (Y/N)	Maintenance Performed (Y/N)	Maintenance Performed and Remaining (Indicate ditch, channel, or spillway by number i.e. 3a = Forebay spillway)
1. Diversion Ditch				
2. By-Pass Channel				
3. Rock-Lined Spillways				
a. Forebay				
b. Precipitation Pool				
b. Bioswale 1				
c. Bioswale 2				
d. Wetland (WL)				
e. Wetland/ Pond (WL/Pond)				
f. By-Pass spillway				
3. Weir				

F. Passive Treatment System Components

Component	Significant Erosion (Y/N)	Berms Stable (Y/N)	Vegetation Successful (Y/N)	Siltation Significant (Y/N)	Water Level Change (Y/N)	Maintenance Performed and Remaining (Indicate component i.e. Forebay)
Forebay						
Precip. Pool						
By-Pass						
BSWL 1						
BSWL2						
WL						
WL/ Pond						
Weir						

G. Wildlife Utilization

Animal sighted or tracks observed: ____________________

Invasive plants observed:____________________

Describe any damage caused to treatment system by wildlife (especially muskrats) and required maintenance: ____________________

____

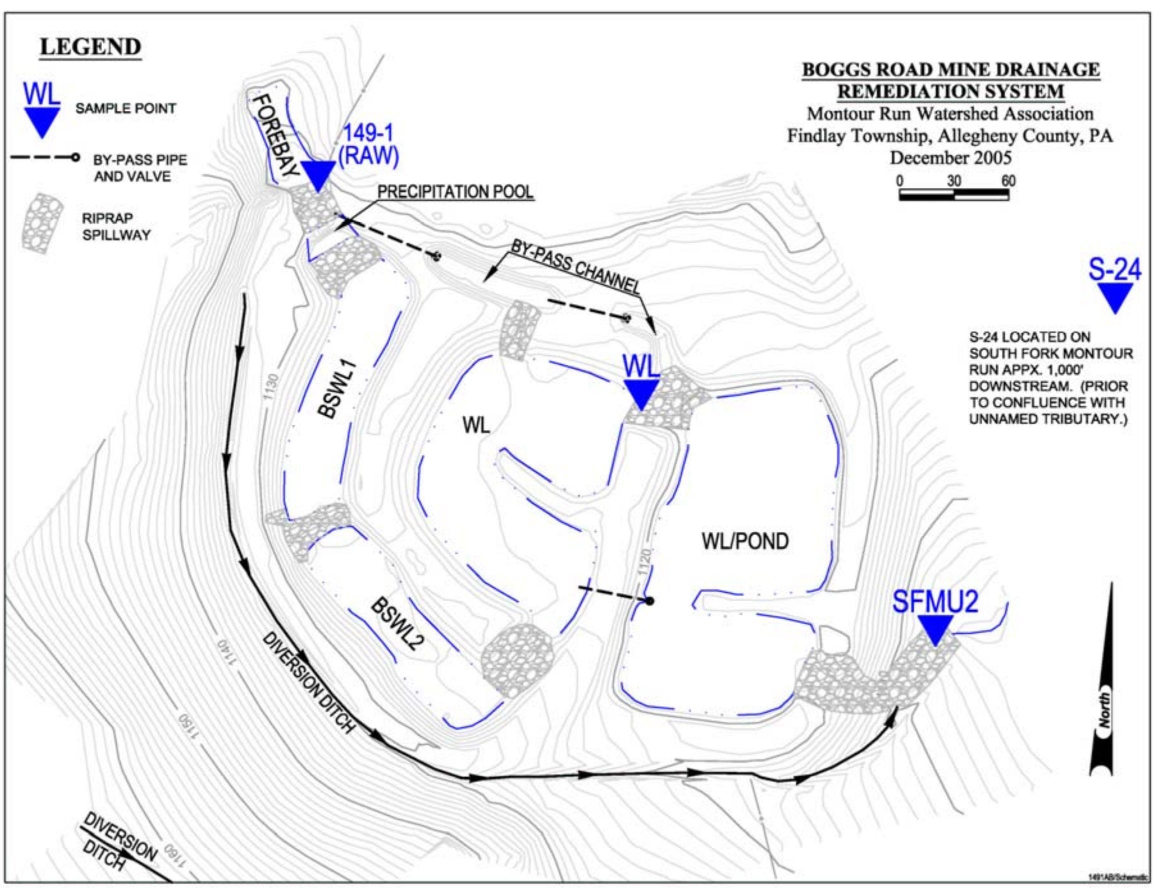
H. & I. Flow Measurement, Field Water Monitoring, and Sample Collection

Water sample locations as marked on plan.

☐ - Not monitored

Sampling Point	Weir Measurement (hundredths feet)	Calculated Flow (gpm)	pH	Temp (°C)	Alkalinity (mg/L)	DO (mg/L)	Iron (mg/L)	Comments	Bottle #	Bottle # (total metals)	Bottle # (diss. metals)
Forebay (Raw)											
WL *(optional)*											
SMFU2 (Effluent)											
S-24 (stream)											

J. Schematic



ANNUAL SLUDGE ACCUMULATION ASSESSMENT REPORT
(Optional)

Project Name:	**Boggs Road Mine Drainage Remediation System**				
Municipality:	**Findlay Township**	County:	**Allegheny**	State:	**PA**
Project Coordinates:	**40° 26' 25''** Lat	**80° 17' 09''**	Long		
Receiving Stream:	**South Fork Montour Run**	Subwatershed:	**Montour Run**	Watershed:	**Ohio River**

Provide sludge assessment for each component including sludge description. The sludge accumulation in the wetland may exceed the crest of the spillway as vegetation continues to grow and filter precipitates. At this site, sludge should be removed if within about 1 to 2 feet of the top of berm.

Inspection Date:				**Inspected by:**	
Time	**Start:**		**End:**	**Organization:**	

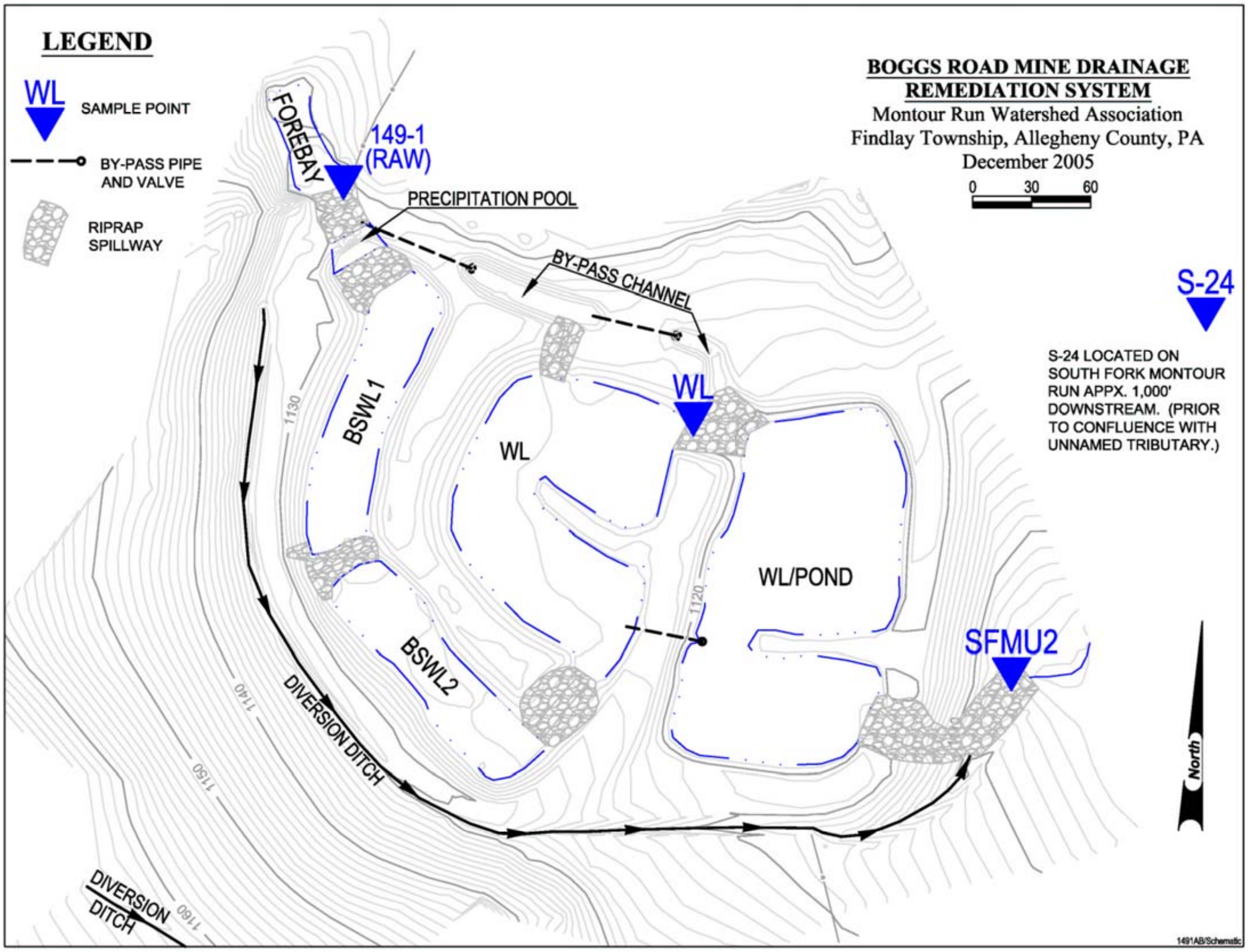
Component	**Sludge Accumulation**		**Sludge Description**	**Comments**
	Estimated Depth (ft)	**Within 1-2' Y/N?**		
Forebay				
Precipitation Pool				
Bioswale 1				
Bioswale 2				
WL				
WL/ Pond				
Weir				

Inspection Date:				**Inspected by:**	
Time	**Start:**		**End:**	**Organization:**	

Component	**Sludge Accumulation**		**Sludge Description**	**Comments**
	Estimated Depth (ft)	**Within 1-2' Y/N?**		
Forebay				
Precipitation Pool				
Bioswale 1				
Bioswale 2				
WL				
WL/ Pond				
Weir				

Inspection Date:				**Inspected by:**	
Time	**Start:**		**End:**	**Organization:**	

Component	**Sludge Accumulation**		**Sludge Description**	**Comments**
	Estimated Depth (ft)	**Within 1-2' Y/N?**		
Forebay				
Precipitation Pool				
Bioswale 1				
Bioswale 2				
WL				
WL/ Pond				
Weir				



LEGEND
WL
SAMPLE POINT
BY-PASS PIPE AND VALVE
RIPRAP SPILLWAY
BOGGS ROAD MINE DRAINAGE REMEDIATION SYSTEM
Montour Run Watershed Association
Findlay Township, Allegheny County, PA
December 2005
0 30 60
FOREBAY
149-1 (RAW)
PRECIPITATION POOL
BY-PASS CHANNEL
S-24
S-24 LOCATED ON SOUTH FORK MONTOUR RUN APPX. 1,000' DOWNSTREAM. (PRIOR TO CONFLUENCE WITH UNNAMED TRIBUTARY.)
BSWL1
WL
WL
WL/POND
1130
1120
BSWL2
SFMU2
1140
1150
DIVERSION DITCH
DIVERSION DITCH
1160
North
1491AB/Schematic

12/2005

WETLAND PLANT DIVERSITY REPORT
(Optional)

Inspection Date:	______________	Project Name:	**Boggs Road Mine Drainage Remediation System**
Inspected by:	______________	Municipality:	**Findlay Township**
Organization:	______________	County:	**Allegheny** State: **PA**
Time Start: ______	End: ______	Project Coordinates:	**40° 26' 25''** Lat **80° 17' 09''** Long
Receiving Stream:	**South Fork of Montour Run**	Subwatershed:	**Montour Run** Watershed: **Ohio River**

Weather (circle one): Snow Heavy Rain Rain Light Rain Overcast Fair/Sunny **Temp(°F):** #32 33-40 41-50 51-60 60+

Wetland: ______________________________

Common Name	Scientific Name	Plot #	Plot Location	Number

Date:

To: Department of the Army
Pittsburgh District Corps of Engineers
William S. Moorhead Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222

Attn: Marcia Haberman

Re: **<u>PASPGP-2 Permit Compliance – Water Quality Monitoring</u>**
Boggs Road Mine Drainage Remediation System
Montour Run Watershed, Findlay Township, Allegheny County

As indicated in the special conditions on the letter from your office dated September 30, 2004, a water quality monitoring report that includes iron and manganese concentrations must be provided to your office on an annual basis for a period of 5 years. As per this letter, a sampling station identified as SFMU2 was established downstream of the passive treatment system on the unnamed tributary as was a sampling station identified as S-24 on South Fork Montour Run that is located downstream of the unnamed tributary.

The following tables provide the requested information:

Pre-Construction

Monitoring Point	Total Iron (mg/L)	Total Manganese (mg/L)
Unnamed Trib (SFMU2)	16.4	7.7
South Fork Montour Run (S-24)	17.85	7.50

Note: Average pre-construction values.

Post-Construction

Monitoring Point	Total Iron (mg/L)	Total Manganese (mg/L)
Unnamed Trib (SFMU2)		
South Fork Montour Run (S-24)		

Note: This water monitoring data was collected on ______________________.

Positive environmental improvements are being realized by the constructed wetland system as documented by the change in in-stream iron concentrations as indicated in the above tables. Please note that the passive treatment system design did not include components to facilitate manganese removal.

If there are any questions or comments please contact us.

From: Montour Run Watershed Association

By:

Sent:

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
149-1	9/18/2002	Estimated	15	6.6	6.4				140	0	75.5		7.0		0.5		1075	54
149-1	10/30/2002	Estimated	20	7.0	6.5				128	0	65.6		7.2		0.5		354	56
149-1	11/21/2002	Estimated	20	7.0	6.4				146	0	63.9		6.4		0.5		1066	50
149-1	12/16/2002	Estimated	25		6.4				140	1	66.7		6.9		0.5		1214	50
149-1	12/24/2002	Assumed	26	6.8	6.2	2540	10	185	57	-44	65.2	50.7	6.4	6.1	0.6	0.2	1223	3
149-1	1/27/2003	Measured	40	6.5	6.5				113	0	56.1		7.4		1.6		1268	30
149-1	2/24/2003	Measured	50	6.4	6.3				127	39	56.2		6.1		1.7		1137	18
149-1	8/25/2005			5.9	5.8	2521	15	112	76	111	88.8	75.4	8.6	8.3	4.3	1.4	1432	19
149-1	9/23/2005			5.8	5.2	2261	16	194	14	51	113.9	110.6	9.4	9.0	2.4	1.5	1751	20
149-1	10/28/2005			5.6	4.9	2191	13	143	7	9	101.1	95.4	7.2	6.7	2.0	1.8	1344	21
149-1	11/23/2005			5.7	6.2	2267		190	133	58	126.0	113.9	8.3	8.1	0.7	0.3	1241	30
149-1	12/2/2005	Assumed	26	5.7	6.4	2225	10	137	127	4	99.9	77.1	8.8	8.5	0.7	0.4	1241	14
149-1	12/20/2005			5.6	6.3	2231	10	125	144	45	88.8	82.4	8.2	8.0	1.8	1.4	1561	10
Min			15	5.6	4.9	2191	10	112	7	-44	56.1	50.7	6.1	6.1	0.5	0.2	354	3
Max			50	7.0	6.5	2540	16	194	146	111	126.0	113.9	9.4	9.0	4.3	1.8	1751	56
Avg			28	6.2	6.1	2319	12	155	104	21	82.1	86.5	7.5	7.8	1.4	1.0	1224	29
Range			35	1.4	1.6	349	6	82	139	156	69.9	63.2	3.3	3.0	3.8	1.6	1398	53

Description: Abandoned mine discharge; seep located at toe of spoil below BFI Landfill in headwaters of South Fork Montour Run; Also known as sampling point "Seep Below BFI"

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
FB	11/23/2005			6.4	6.1	2308		116	27	61	115.8	110.8	9.4	9.3	1.7	0.4	1348	54
FB	12/20/2005			6.2	6.3	2226		122	78	71	84.3	79.3	9.6	9.5	2.1	0.6	1748	14
Min				6.2	6.1	2226		116	27	61	84.3	79.3	9.4	9.3	1.7	0.4	1348	14
Max				6.4	6.3	2308		122	78	71	115.8	110.8	9.6	9.5	2.1	0.6	1748	54
Avg				6.3	6.2	2267		119	52	66	100.1	95.0	9.5	9.4	1.9	0.5	1548	34
Range				0.3	0.2	82		6	51	10	31.6	31.5	0.2	0.2	0.4	0.2	400	40

Description: Forebay; Boggs Road passive treatment system; Receives the 149-1 abandoned mine discharge; Sampled at effluent spillway

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
BSWL1	11/23/2005			6.9	6.2	2304		83	20	53	75.1	72.8	10.2	10.1	0.7	0.2	1423	71
Min				6.9	6.2	2304		83	20	53	75.1	72.8	10.2	10.1	0.7	0.2	1423	71
Max				6.9	6.2	2304		83	20	53	75.1	72.8	10.2	10.1	0.7	0.2	1423	71
Avg				6.9	6.2	2304		83	20	53	75.1	72.8	10.2	10.1	0.7	0.2	1423	71
Range				0.0	0.0	0		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0

Description: Bioswale Wetland 1; Boggs Road passive treatment system; Receives influent from Forebay; Sampled at effluent spillway

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
BSWL2	8/25/2005			6.2	6.2	2480	26	78	42	17	40.3	27.8	12.2	11.7	0.9	0.1	1396	21
BSWL2	9/23/2005			6.2	6.1	2282	21	75	30	-14	42.2	40.3	12.9	12.3	0.1	0.0	1478	101
BSWL2	10/28/2005			6.5	6.7	2310	11	134	104	-67	18.7	17.9	12.4	11.8	0.4	0.0	1403	8
BSWL2	11/23/2005			6.9	6.4	2224		73	35	25	60.5	56.4	10.2	10.1	0.2	0.1	1241	38
Min				6.2	6.1	2224	11	73	30	-67	18.7	17.9	10.2	10.1	0.1	0.0	1241	8
Max				6.9	6.7	2480	26	134	104	25	60.5	56.4	12.9	12.3	0.9	0.1	1478	101
Avg				6.4	6.4	2324	19	90	53	-10	40.4	35.6	11.9	11.5	0.4	0.1	1380	42
Range				0.7	0.6	256	16	61	74	92	41.7	38.6	2.7	2.2	0.8	0.1	237	93

Description: Bioswale Wetland 2; Boggs Road passive treatment system; Receives influent from BSWL1; Sampled at effluent spillway

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
WL	8/25/2005			6.8	6.5	2286	27	30	28	-8	1.7	0.8	11.0	10.1	0.0	0.0	1233	6
WL	9/23/2005			6.7	6.6	2300	23	36	26	-9	3.0	2.2	14.0	13.3	0.1	0.0	2037	6
WL	10/28/2005			6.4	6.4	1965	10	55	33	-13	10.5	9.4	9.6	9.0	0.0	0.0	1223	7
WL	11/23/2005			6.8	6.6	2324		34	34	6	27.5	23.8	11.4	11.3	0.2	0.2	1487	37
WL	12/20/2005			7.0	6.5	2314		92	59	18	38.3	34.3	11.7	11.5	0.5	0.1	1760	20
Min				6.4	6.4	1965	10	30	26	-13	1.7	0.8	9.6	9.0	0.0	0.0	1223	6
Max				7.0	6.6	2324	27	92	59	18	38.3	34.3	14.0	13.3	0.5	0.2	2037	37
Avg				6.8	6.5	2238	20	49	36	-1	16.2	14.1	11.5	11.0	0.2	0.1	1548	15
Range				0.6	0.2	359	17	62	33	31	36.6	33.5	4.4	4.3	0.5	0.1	814	31

Description: Wetland; Boggs Road passive treatment system; Receives influent from BSWL2

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SFMU2	11/8/2001	Measured	9		6.6				104	0	9.2		8.2		0.5		1026	
SFMU2	1/22/2002	Measured	22		6.6				92	0	30.0		7.4		0.5		1184	
SFMU2	2/19/2002	Measured	29		6.7				90	0	28.7		7.5		0.5		1053	
SFMU2	3/19/2002	Measured	29		6.7				88	0	22.5		7.0		0.5		682	
SFMU2	4/16/2002	Measured	50		6.4				56	19	24.0		7.6		0.5		667	
SFMU2	5/30/2002	Measured	50		6.4				48	10	13.9		7.9		0.5		1201	8
SFMU2	6/25/2002	Measured	45		6.4				48	9	7.2		8.5		0.5		1106	18
SFMU2	7/29/2002	Measured	29		6.9				56	0	7.0		9.2		0.5		1421	
SFMU2	8/26/2002	Measured	17		6.8				76	0	12.4		8.9		0.5		1381	
SFMU2	9/18/2002	Measured	17		6.7				80	0	14.4		8.9		0.5		1323	
SFMU2	10/30/2002	Measured	22		6.8				96	0	12.8		7.7		0.5		357	
SFMU2	11/21/2002	Measured	22		6.8				88	0	9.2		7.0		0.5		1540	
SFMU2	12/16/2002	Measured	25	7.0	6.5				84	0	11.5		7.1		0.5		1071	20
SFMU2	1/27/2003	Measured	45	6.7	6.7				74	0	24.9		6.0		0.5		1093	22
SFMU2	2/24/2003	Measured	55	6.8	6.8				62	0	18.4		6.3		0.5		1077	22
SFMU2	8/25/2005			7.7	6.8	1899	26	36	39	-21	0.1	0.1	7.6	7.4	0.0	0.0	991	4
SFMU2	9/23/2005			7.4	7.1	2268	24	22	29	-19	0.4	0.3	13.3	12.7	0.1	0.0	2690	4
SFMU2	10/28/2005			7.0	6.9	1708	10	32	23	23	3.7	1.9	8.0	7.9	2.1	0.0	1501	8
SFMU2	11/23/2005			7.2	7.0	2309		32	33	-12	4.5	3.6	10.6	10.4	0.1	0.1	1295	11
SFMU2	12/2/2005	Weir	26	7.0	6.9	1991	8	31	29	-3	8.3	5.7	10.7	10.1	0.2	0.1	1193	8
SFMU2	12/20/2005			7.4	6.6	2278		66	43	6	20.7		11.8		0.3		1701	11
Min			9	6.7	6.4	1708	8	22	23	-21	0.1	0.1	6.0	7.4	0.0	0.0	357	4
Max			55	7.7	7.1	2309	26	66	104	23	30.0	5.7	13.3	12.7	2.1	0.1	2690	22
Avg			31	7.1	6.7	2076	17	37	64	1	13.5	2.3	8.4	9.7	0.5	0.0	1217	12
Range			46	1.0	0.7	601	18	44	81	44	29.9	5.6	7.3	5.4	2.0	0.1	2333	18

Description: Abandoned Mine Discharge; South Fork Montour Run Upstream segment; Below BFI Landfill; Also known as 149-1a and PRE1(SFMU2); Final effluent of Boggs Road passive treatment system as of 8/25/05; sampled at weir

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
SFMU2B	12/2/2005			7.0	6.9	1986	7	30	35	-20	8.1	5.5	10.8	10.7	0.3	0.2	1267	10
Min				7.0	6.9	1986	7	30	35	-20	8.1	5.5	10.8	10.7	0.3	0.2	1267	10
Max				7.0	6.9	1986	7	30	35	-20	8.1	5.5	10.8	10.7	0.3	0.2	1267	10
Avg				7.0	6.9	1986	7	30	35	-20	8.1	5.5	10.8	10.7	0.3	0.2	1267	10
Range				0.0	0.0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0	0

Description: Unnamed tributary to South Fork Montour Run; Located below passive treatment system

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
S-24	1/14/1997				6.2				32	30	16.8		8.1		0.9		1064	4
S-24	8/13/1997				6.2				36	32	20.8		8.9		0.8		932	36
S-24	2/10/1998				6.4				52	0	14.3		6.7		0.8		933	10
S-24	4/7/1998				6.3				38	1	15.7		7.6		1.2		1100	96
S-24	8/20/1998				6.3				40	0	14.2		9.0		0.3		1105	12
S-24	7/21/1999				6.4				38	0	35.1		7.8		3.6		1143	22
S-24	2/15/2000				6.8				66	0	8.1		4.4		0.7		479	
S-24	12/2/2005			7.2	7.3	1741	5	71	63	-46	5.1	3.8	6.7	6.6	0.3	0.1	915	17
S-24	12/20/2005			7.5	6.8	1970		78	58	-30	8.3	7.6	7.9	7.9	0.2	0.1	1086	16
Min				7.2	6.2	1741	5	71	32	-46	5.1	3.8	4.4	6.6	0.2	0.1	479	4
Max				7.5	7.3	1970	5	78	66	32	35.1	7.6	9.0	7.9	3.6	0.1	1143	96
Avg				7.4	6.5	1856	5	75	47	-1	15.4	5.7	7.5	7.2	1.0	0.1	973	27
Range				0.3	1.1	229	0	7	34	78	30.1	3.8	4.6	1.3	3.4	0.0	664	92

Description: South Fork Montour Run prior to BFI Tributary

Montour Run Water Quality Database

Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
MP6	7/23/1996	Measured	36		5.2				28	124	38.6		9.4		3.9		1074	
MP6	8/20/1996	Measured	29		5.0				19	138	41.5		9.6		3.9		950	
MP6	9/16/1996	Measured	21		5.0				24	110	38.7		8.6		3.4		764	4
MP6	11/20/1996	Measured	29		5.4				38	76	23.7		9.1		3.5		1050	14
MP6	12/11/1996	Measured	32		5.4				42	86	22.1		8.7		3.2		999	20
MP6	1/22/1997	Measured	38		5.1				30	94	26.9		9.8		3.6		1014	24
MP6	2/26/1997	Measured	38		5.8				64	112	17.4		7.2		2.1		837	8
MP6	3/12/1997	Measured	41		5.4				42	54	19.1		9.0		2.6		889	8
MP6	4/23/1997	Measured	38		5.6				54	84	25.3		10.2		3.2		1184	0
MP6	5/8/1997	Measured	32		5.5				46	54	25.9		10.1		2.9		1097	4
MP6	6/5/1997	Measured	45		5.8				74	72	17.1		7.6		2.1		896	8
MP6	7/17/1997	Measured	29		5.5				46	104	24.6		9.6		2.5		936	
MP6	8/18/1997	Measured	22		5.8				82	158	21.1		7.5		1.8		910	4
MP6	9/30/1997	Measured	12		5.5				50	132	25.6		8.2		2.2		962	
MP6	10/27/1997	Measured	8		5.5				40	114	25.5		8.7		2.3		1007	12
MP6	11/18/1997	Measured	22		5.1				26	82	8.2		7.8		2.1		778	
MP6	3/26/1998	Measured	50		5.4				36	48	23.1		10.2		2.5		1261	12
MP6	4/23/1998	Measured	45		5.8				58	16	19.8		8.7		2.1		1118	
MP6	5/20/1998	Measured	45		5.8				66	0	21.5		9.1		2.2		1099	
MP6	6/29/1998	Measured	25		6.1				84	0	16.1		6.8		1.5		902	
MP6	7/22/1998	Measured	45		5.6				56	17	20.8		8.9		1.9		981	
MP6	8/20/1998	Measured	22		5.3				30	44	24.0		8.4		1.7		953	
MP6	9/29/1998	Measured	10		5.3				34	38	26.2		8.9		1.9		955	4
MP6	10/28/1998	Measured	12		5.1				26	46	23.0		8.5		1.8		991	4
MP6	12/14/1998	Measured	5		5.3				30	42	21.7		9.0		1.8		1028	4
MP6	1/20/1999	Measured	45		6.0				72	0	1.2		5.2		1.2		745	
MP6	2/22/1999	Measured	20		5.7				62	0	9.1		8.4		1.6		1308	
MP6	3/17/1999	Measured	45		5.6				50	3	12.3		8.3		1.6		942	

Montour Run Water Quality Database

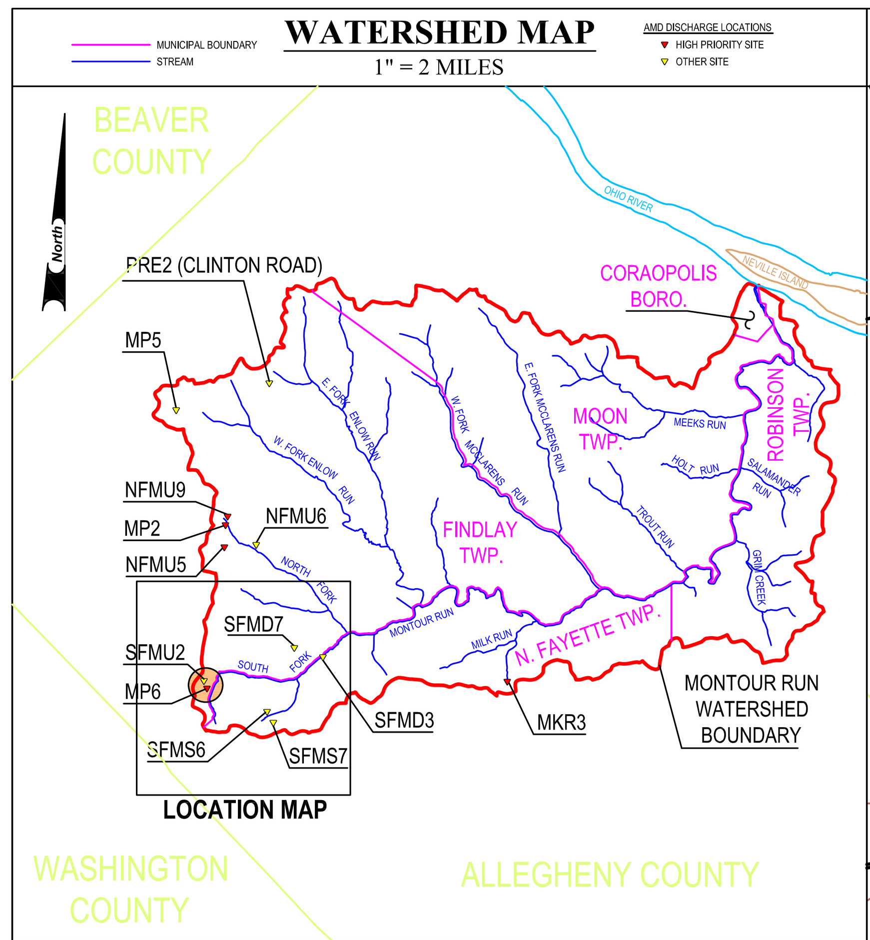
Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
MP6	4/19/1999	Measured	50		6.0				84	0	11.4		6.2		1.2		915	
MP6	5/24/1999	Measured	40		6.0				92	0	15.2		7.0		1.4		1112	10
MP6	6/23/1999	Measured	25		5.2				24	42	17.7		7.5		1.6		978	4
MP6	7/22/1999	Measured	19		5.3				26	40	20.3		7.6		1.9		907	
MP6	8/11/1999	Measured	17		5.3				36	18	16.0		6.9		1.8		688	12
MP6	9/13/1999	Measured	12		5.1				28	50	18.9		7.4		1.5		1009	
MP6	10/25/1999	Measured	8		4.8				13	50	21.1		9.2		1.4		1051	
MP6	11/15/1999	Measured	14		5.2				28	70	10.9		8.2		1.5		1009	
MP6	12/2/1999	Measured	17		5.3				30	11	5.0		7.7		1.6		1085	4
MP6	1/11/2000	Measured	29		5.7				70	0	3.0		6.5		1.2		891	4
MP6	2/7/2000	Measured	45		5.2				30	26	8.4		8.4		1.6		1055	
MP6	3/7/2000	Measured	36		5.6				58	0	5.0		7.4		1.3		798	4
MP6	4/25/2000	Measured	5		5.9				78	0	10.7		8.2		1.4		1348	
MP6	5/23/2000	Measured	29		5.7				64	0	11.7		6.8		1.5		1433	
MP6	6/28/2000	Measured	45		5.9				84	0	11.9		7.3		1.0		970	12
MP6	7/20/2000	Measured	40		5.6				64	0	13.9		7.8		1.2		883	
MP6	8/28/2000	Measured	36		5.6				54	0	17.7		7.3		1.5		1043	4
MP6	9/26/2000	Measured	45		5.8				84	0	11.8		5.4		0.7		919	14
MP6	10/31/2000	Measured	25		5.6				50	7	16.8		7.0		9.5		950	
MP6	11/29/2000	Measured	17		5.7				68	0	15.9		5.3		1.0		836	12
MP6	1/30/2001	Measured	45		6.2				120	0	6.4		3.5		0.6		702	6
MP6	2/28/2001	Measured	29		5.9				80	0	4.6		4.9		0.7		726	14
MP6	3/19/2001	Measured	66		5.9				80	0	6.8		4.4		0.9		870	20
MP6	4/25/2001	Measured	78		5.9				66	0	7.3		5.3		0.7		998	
MP6	11/8/2001	Measured	8		5.7				72	3	15.6		7.5		0.6		703	
MP6	1/22/2002	Measured	19		5.5				52	1	4.1		7.4		0.7		818	12
MP6	2/19/2002	Measured	36		5.6				52	7	3.7		8.1		0.8		1111	6
MP6	3/19/2002	Measured	40		5.7				74	0	4.9		7.2		0.7		837	4

Montour Run Water Quality Database

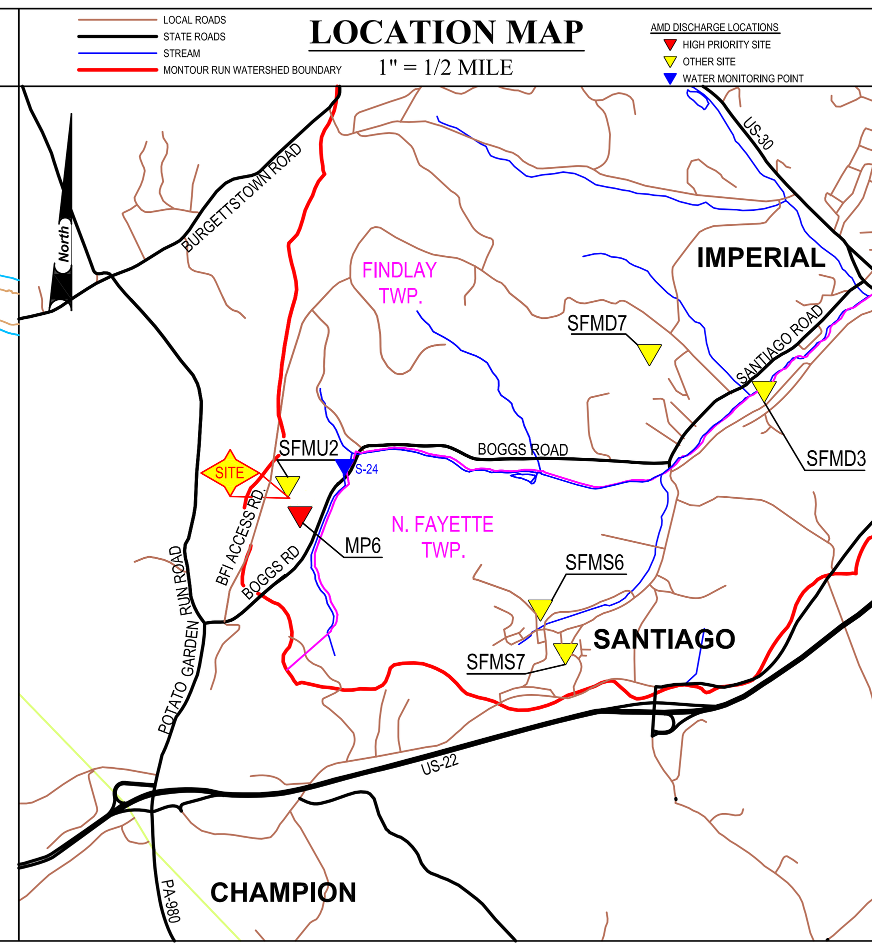
Sample Point	Date	Method of Flow Meas.	Flow (gpm)	Field pH	Lab pH	Spec. cond. (umhos/cm)	Field Temp (C)	Alk. (F) (mg/L)	Alk. (L) (mg/L)	Acid. (mg/L)	Fe (mg/L)	D. Fe (mg/L)	Mn (mg/L)	D. Mn (mg/L)	Al (mg/L)	D. Al (mg/L)	Sulfate (mg/L)	Susp. Solids (mg/L)
MP6	4/16/2002	Measured	45		5.8				84	0	5.2		6.9		0.7		1262	8
MP6	5/30/2002	Measured	66		5.8				88	0	8.7		7.0		0.6		1152	
MP6	6/25/2002	Measured	45		5.6				62	19	12.7		8.4		0.8		948	
MP6	7/29/2002	Measured	29		5.0				50	0	16.1		9.3		0.9		1199	
MP6	8/26/2002	Flow	19		5.4				48	39	16.9		8.5		1.0		1377	
MP6	9/18/2002	Measured	10		5.4				40	65	17.9		8.3		0.8		1072	
MP6	10/30/2002	Measured	17		5.6				64	14	12.8		7.0		0.6		356	
MP6	11/21/2002	Measured	22		5.4				48	5	4.4		7.4		0.8		961	
MP6	12/16/2002	Measured	36		5.9				84	0	2.1		5.0		0.0		268	
MP6	1/27/2003	Measured	32	5.8	5.5				56	4	9.3		8.8		1.2		1119	
MP6	2/25/2003	Measured	40	5.7	5.7				66	0	7.6		7.7		0.7		960	0
Min			5	5.7	4.8				13	0	1.2		3.5		0.0		268	0
Max			78	5.8	6.2				120	158	41.5		10.2		9.5		1433	24
Avg			31	5.8	5.5				55	35	15.7		7.7		1.7		969	8
Range			73	0.1	1.4				107	158	40.3		6.7		9.5		1165	24

Description: Monitoring Point 6; Combination of Deep Mine and Surface Mine Discharge;

WATERSHED MAP
1" = 2 MILES



LOCATION MAP
1" = 1/2 MILE



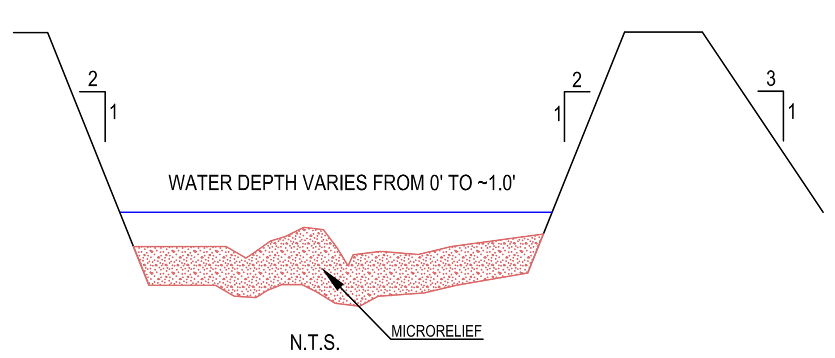
PASSIVE TREATMENT SYSTEM SUMMARY

COMPONENT	SIZE (SF)	APPX DEPTH OF DEEP POOL (FT)	DESCRIPTION
FOREBAY	1,140	---	CAPTURE DISCHARGES AND PARTICULATE SETTLING
PRECIP POOL	360	---	PRECIPITATION POOL - IRON OXIDATION AND PARTICULATE SETTLING
BSWL1	4,270	3	BIOSWALE/WETLAND - IRON OXIDATION AND PARTICULATE SETTLING
BSWL2	4,120	3	BIOSWALE/WETLAND - IRON OXIDATION AND PARTICULATE SETTLING
WL	11,100	3	AEROBIC WETLAND - IRON OXIDATION AND PARTICULATE SETTLING
WL/POND	15,100	5	POLISHING WETLAND AND POND COMPLEX

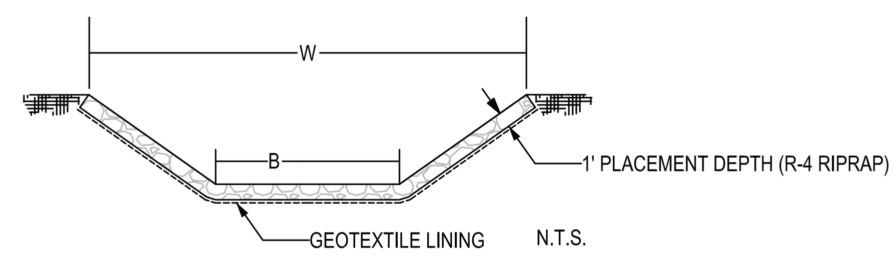
LEGEND

- CONTOUR - INDEX
- CONTOUR - INTERMEDIATE
- PROPERTY LINE (APPX. LOCATION)
- CHAINLINK FENCE
- WATER
- MONITORING WELL (BFI LANDFILL)
- DIVERSION DITCH
- 4" SCH 40 BY-PASS PIPE (APPX. LOCATION)
- SLIDE GATE VALVE
- PAVED ROAD
- DIRT/GRAVEL ROAD
- RIP-RAP OUTLET LINED CHANNEL (R-4)
- WATER SAMPLE POINT
- WETLAND SUBSTRATE
- HIGH MARSH AREA
- WOODY DEBRIS (APPX. LOCATION)
- DEEP POOL (APPX. LOCATION - SEE NOTE)

HIGH MARSH DETAIL



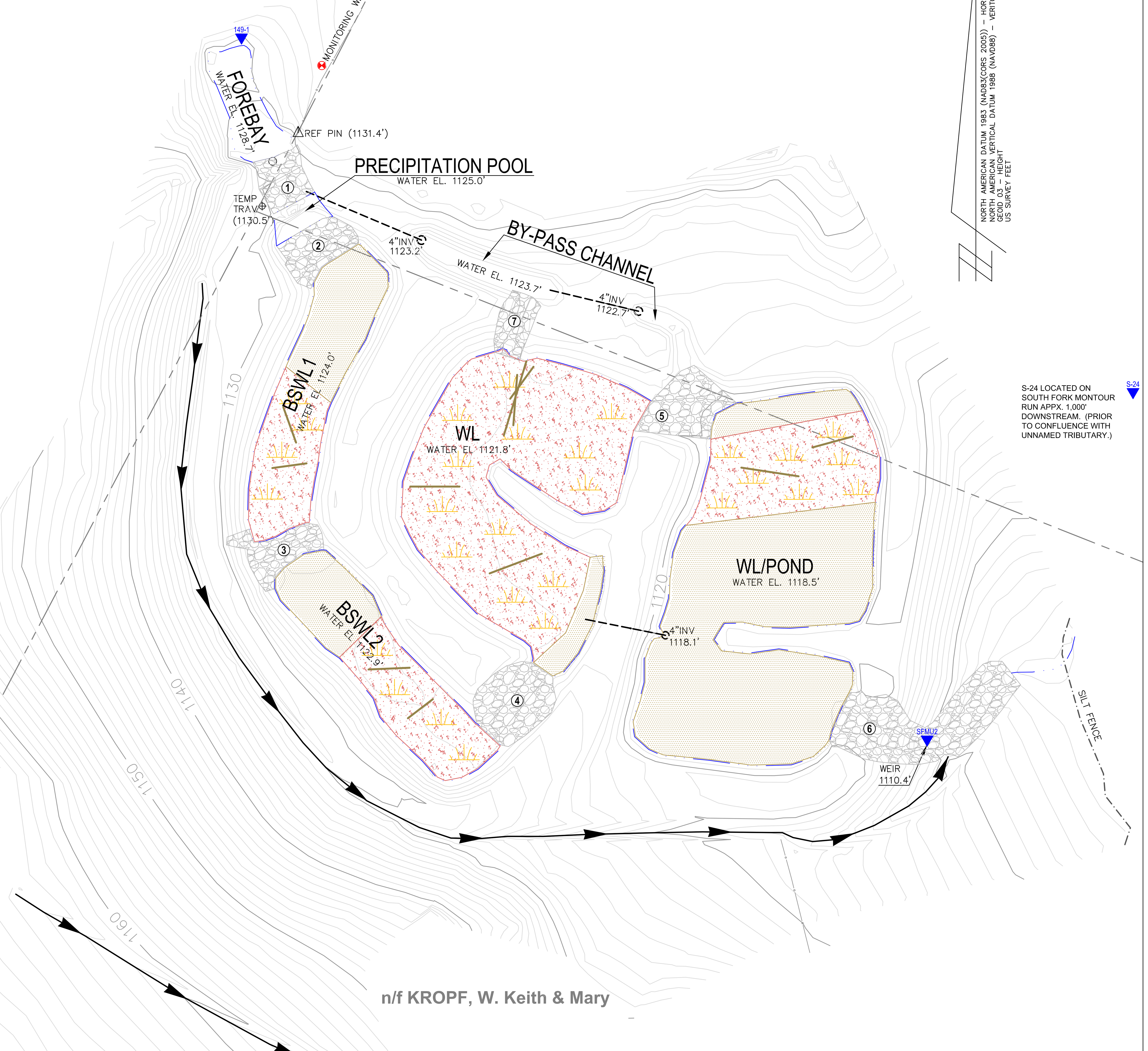
RIP-RAP CHANNEL DETAIL

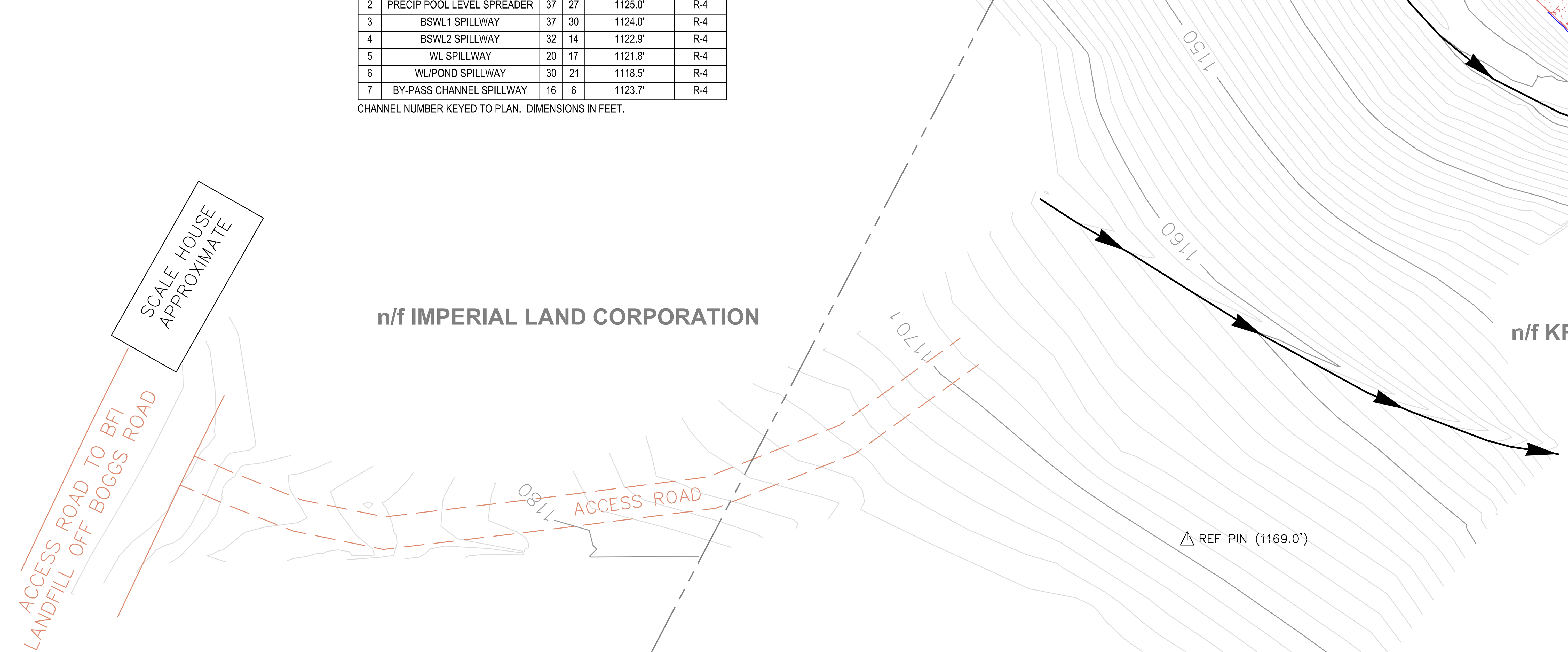


RIP-RAPPED CHANNELS

#	CHANNEL LOCATION	W	B	OUTLET EL.	LINING
1	FOREBAY LEVEL SPREADER	23	23	1128.7'	R-4
2	PRECIP POOL LEVEL SPREADER	37	27	1125.0'	R-4
3	BSWL1 SPILLWAY	37	30	1124.0'	R-4
4	BSWL2 SPILLWAY	32	14	1122.9'	R-4
5	WL SPILLWAY	20	17	1121.8'	R-4
6	WL/POND SPILLWAY	30	21	1118.5'	R-4
7	BY-PASS CHANNEL SPILLWAY	16	6	1123.7'	R-4

CHANNEL NUMBER KEYED TO PLAN. DIMENSIONS IN FEET.





Notes:

Base map prepared by ESI Positioning (Greensburg, PA) in December 2005 using global positioning and conventional measuring techniques with additional information from site inspections provided by BioMost, Inc.

The coordinates and basis of bearing for this topographic survey were determined using GPS relative positioning techniques. The positions are referenced to the National Geodectic Survey continuously operating referenced stations current adjustment horizontally projected to Zone PA South and vertically projected using GEOID03 to NAVD88 expressed in US feet.

The positional tolerance meets or exceeds the current alta requirement of 0.07' + 50 ppm.

This survey does not depict any relation to ownership, boundaries, easements, rights-of-way or any other instrument or evidence pertaining to the requirements of a boundary survey.

Wetland area planted with native species by volunteers from the Montour Run Watershed Association, Aquascape Wetland and Environmental Services and BioMost, Inc.

The number and orientation of woody debris is representative.

Bottom elevation of wetlands varies due to microrelief to enhance treatment performance and wildlife value. Water depth for High Marsh areas ranges between 0' - 1.0'.

Deep pools shown on plan are approximate and vary in depth from 1' to 5'. (See Passive Treatment System Summary Table.)

Surface areas calculated at approximate water elevation. Actual water elevations may change based on spillway conditions, vegetation, and other factors.

30 15 0 30 60

"AS-BUILT DRAWING"

MONTOUR RUN WATERSHED ASSOCIATION
BOGGS ROAD MINE DRAINAGE REMEDIATION SYSTEM

MONTOUR RUN WATERSHED
SOUTH FORK MONTOUR RUN SUBWATERSHED
ALLEGHENY COUNTY, PENNSYLVANIA

Scale: 1" = 30' December 2005

BioMost, Inc., Cranberry Township, Pennsylvania
Mining and Reclamation Services

1491AB

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Growing Greener
Goals and Accomplishments Worksheets

Project Name Boggs Road Mine Drainage Remediation System

Project Number SW30249 County Allegheny

State Watershed Plan Name and Code Montour Run – 20G
(e.g., Clark-Paxton Creeks – 7C)

Date Prepared 01 / 26 / 2006 (month/day/year)

This Report is *(choose one)*:

☐ Project Goals

☒ Project Accomplishments *(to be submitted with final report)*

Project Type *(check all that apply)*

☐ Organization of a Watershed Group *(fill out Sheet A*)*

Watershed Assessments and Development of Restoration and/or Protection Plan
(check all that apply and fill out sheet B)*

- ☐ AML/AMD
- ☐ Non-Point Source
- ☐ Assessment
- ☐ Development of Restoration Plan
- ☐ Development of Protection Plan

Implementation of Watershed Restoration and/or Protection Project
(check all that apply and fill out Sheets C, D, E, F, and G)*

- ☒ AML/AMD
- ☐ Oil and Gas
- ☐ Non-Point Source
- ☐ Restoration
- ☐ Protection

☐ Demonstration *(fill out Sheet H*)*

☒ Education/Outreach *(fill out Sheet I*)*

*Please fill out all the appropriate information on the sheets corresponding to your project type. Leave blank any sheets or information on the sheets that do not apply to your specific project. If you have any questions call the Grants Center at 717-705-5400.

Sheet C

Receiving Stream South Fork Montour Run, Tributary to Montour Run name/location

Receiving Stream Benefits

	Upstream Quality Before	Upstream Quality After		Downstream Quality Before	Downstream Quality After	
Iron	64	103	mg/L	16	6	mg/L
pH	6.4	5.8	S.U.	6.6	6.9	S.U.
Acid			mg/L as $CaCO_3$	3	0	mg/L as $CaCO_3$
Alk	122	83	mg/L as $CaCO_3$	76	33	mg/L as $CaCO_3$
Al	1	2	mg/L	0	0	mg/L
Mn	7	8	mg/L	8	11	Mg/L

AMD Treatment

- ☐ Anoxic Limestone Drain ______ tons Limestone(LS)
- ☐ Successive Alkalinity Producing System (SAP) ______ tons (LS) ______ tons organic matter
- ☒ Wetlands 0.8 aerobic acres ______ anaerobic acres
- ☐ Diversion Wells ______ # ______ total LS capacity
- ☐ Settling Ponds ______ ______ capacity (gpm)
- ☐ Limestone Channel ______ ft. OLC ______ ft. MOLC
- ☐ Limestone Dosing/Dumping ______ tons LS
- ☐ Reverse Alkalinity Producing Systems ______ #
- ☐ Bactericide Remediation ______ lbs/acre
- ☐ Beneficial Use of Dredged Material ______ tons
- ☐ Manganese Oxidizing Bacteria Systems ______ #

Total Treated Flow Rate

26 gpm average 26 gpm high

Predicted lifespan of system 25 years

Sludge Capacity 25 years

Contaminants removed/Contained by system (average)

Iron 25 ppd Al ______ ppd

Mn ______ ppd Acid ______ ppd

Excess Alkalinity added ______ ppd

pH change 6 influent 7 effluent

AML

- ☐ Openings Closed ______ #
- ☐ High Walls Removed ______ Feet
- ☐ Land Remined ______ Acres
- ☐ Wildlife Habitat Improved ______ Acres
- ☒ Trees Planted 25 #
- ☐ Sealing Mine Portals ______ # ______ wet or dry seal
- ☐ Revegetation ______ acres
- ☐ Grout Injection ______ tons
- ☐ Mine Capping ______ acres

Oil and Gas

Wells Plugged ______ #

Total Flow Before ______ gpm

Total Flow After ______ gpm

Contaminants Removed/Prevented

Iron ______ (ppd) pounds per day

Acidity ______ (ppd)

Alkalinity ______ (ppd)

Wildlife Habitat Created ______ acres

Describe Activities to Date: Installed aerobic wetland-type passive treatment system to treat high-iron, alkaline abandoned mine discharge.

Education Project/Outreach

Schools reached	______________	number
Children reached	______________	number
Adults reached	______________	number
Brochures distributed	______________	number
Newspaper articles	13	number
Radio/TV spots	______________	number
Magazines	______________	number
Web site hits	______________	number
Training sessions held	______________	number
	______________	attendance
Workshops held	2	number
	50+	attendance

Describe your efforts to date: